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CANADA:

THE COUNTRY OF THE TWENTIETH CENTURY

By WATSON GRIFFIN

Published by authority of
Sir GEORGE E. FOSTER, K.C.M.G.,
Minister of Trade and Commerce.

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OTTAWA, November 1, 1915.

Sir GEORGE E. FOSTER, K.C.M.G.,
Minister of Trade and Commerce,
Ottawa, Canada.

SIR,—I have the honour to submit herewith "Canada the Country of the Twentieth Century," a description of the Dominion of Canada prepared according to instructions for the purpose of giving business men who have never visited the Dominion a comprehensive but epitomized review of its agricultural, forest, and mineral resources, its industrial and commercial development and its geographical relation to the markets of the world.

I have the honour to be, sir,
Your obedient servant,

WATSON GRIFFIN.

87195—1½

REFERENCE.

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Chapter I.

THE COUNTRY OF THE TWENTIETH CENTURY.

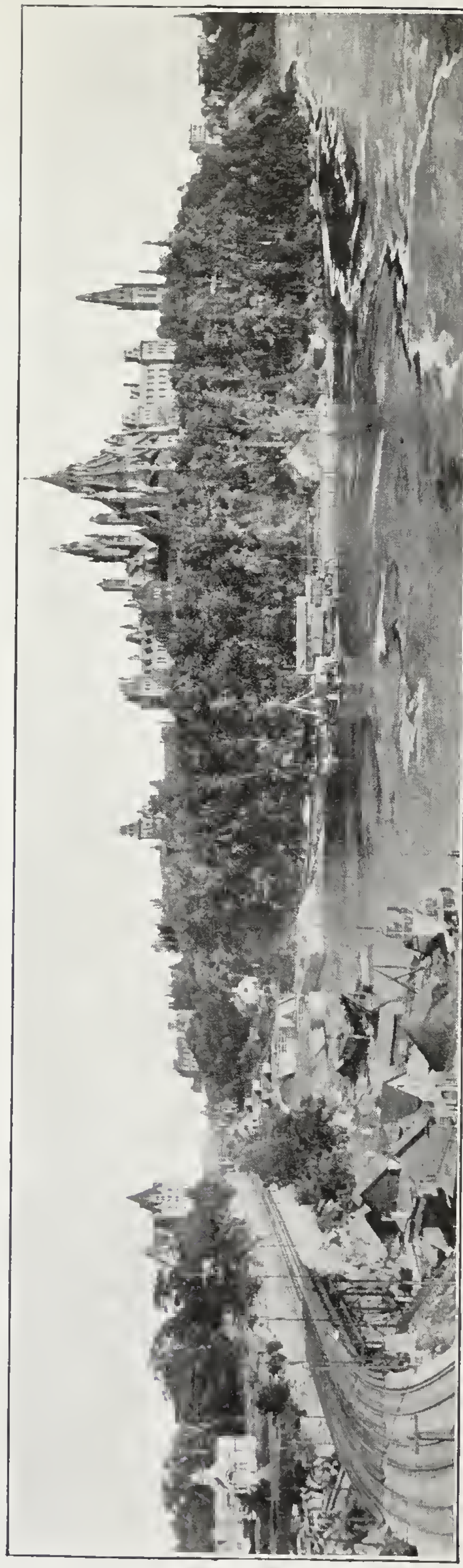
The Dominion of Canada extending from the Atlantic ocean to the Pacific and from the United States boundary to the Arctic ocean, includes the whole northern half of the continent of America, excepting the territory of Alaska at the extreme northwest corner, the British colony of Newfoundland Island, and a narrow strip of the Labrador coast which is under Newfoundland jurisdiction. It has an area of 3,729,665 square miles of land and water without including any tidal waters excepting the section of the St. Lawrence river between the Saguenay river and the foot of lake St. Peter. The area of Canada is about the same as that of Europe. There is some difference of opinion among authorities regarding the exact location of the boundary line between Europe and Asia and the area of Europe is variously estimated at from 3,570,000 square miles to 3,988,500 square miles. The area of the United States, excluding the territory of Alaska, is 3,026,789 square miles, and including Alaska is 3,613,189 square miles, a little less than that of Canada.

The continent of North America extends into the tropics and nearly half of it lies farther south than Europe. The most northern sections of the United States and the southern districts of Canada lie within the same degrees of latitude as the countries of southern Europe. The most southern land in Canada is Pelee island in lake Erie, in latitude N. 42° 16′, about the same latitude as the Italian island of Pianosa. The northwest corner of the Canadian Yukon territory is in 70° north latitude, and some of the Canadian islands in the Arctic ocean to the northeast are in a little higher latitude. Mackenzie bay, at the mouth of the Mackenzie river, in the Canadian Northwest Territories, is in about the same latitude as the White sea.

There is continuous railway connection through Canadian territory from the city of Sydney, in the province of Nova Scotia, to the city of Vancouver, in the province of British Columbia, a railway distance of 3,883 miles without any break excepting Canso strait, across which trains are ferried. The distance by rail and water from Sydney to Dawson City in the famous Klondike gold country of the Canadian Yukon territory is 5,383 miles.

From a commercial point of view the geographical situation of Canada is remarkable. Reaching out in the Atlantic and Pacific oceans, much nearer to both Europe and Asia than the United States, it seems destined to be the world's highway for travellers and for goods requiring fast transportation. Well constructed transcontinental railways offer every modern convenience and comfort to travellers from ocean to ocean. While Canadian railway trains can approach much nearer to Europe than

Dominion Parliament Buildings, Ottawa.



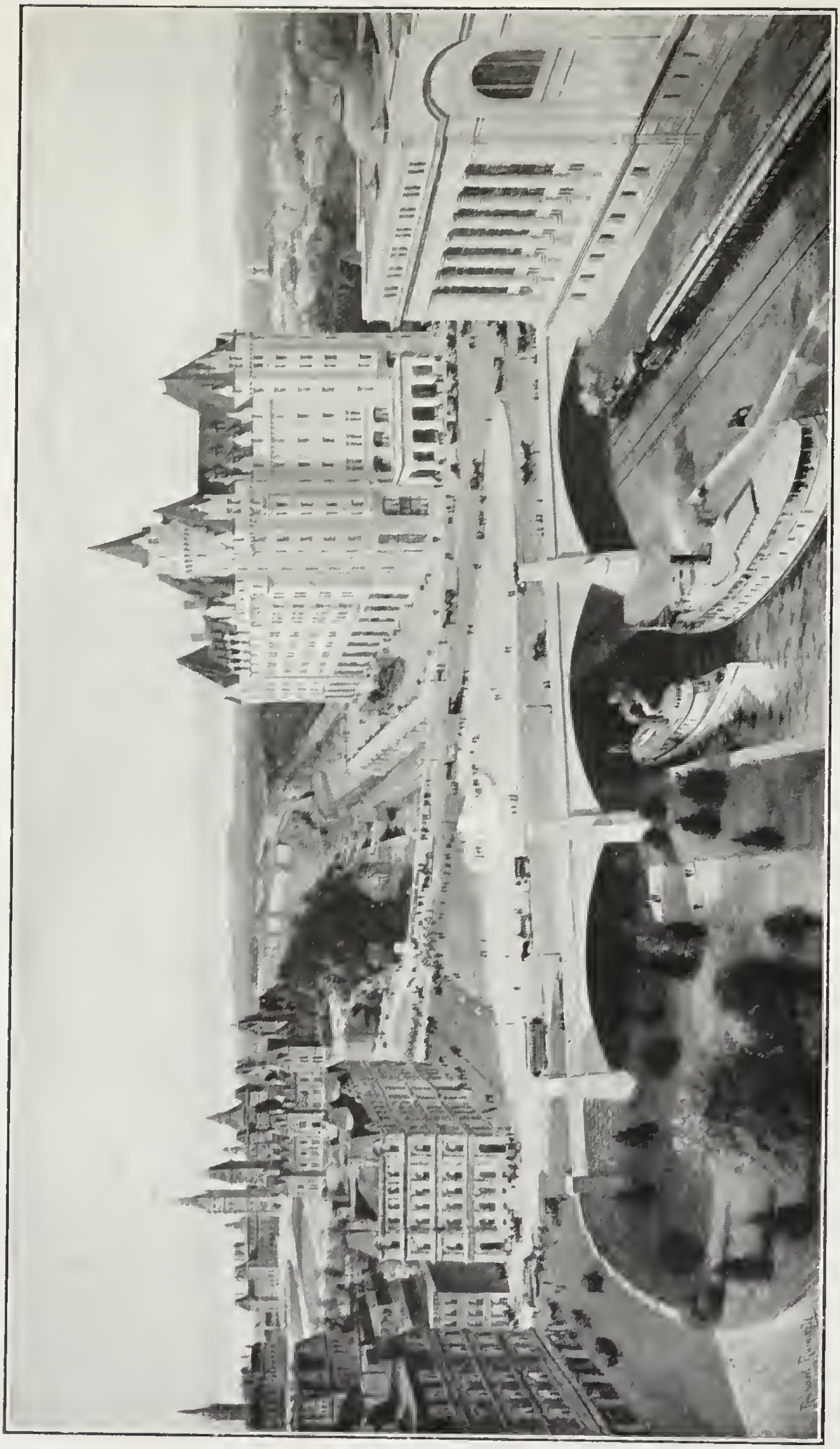
Parliament Buildings from Nepean Point.

those of the United States, large ocean vessels from Europe go up the St. Lawrence river over one thousand miles into the interior of the country for over seven months of the year.

Any one looking at the map of Canada must be impressed with the extraordinary facilities for water communication. The Maritime Provinces are almost surrounded by deep water and their coasts are indented with a great number of fine harbours. The St. Lawrence river and the Great Lakes give communication in summer between the sea and the central provinces, while the West can be reached by way of Hudson strait and the vast interior waters of Hudson bay, although navigation of the strait is obstructed by floating ice for the greater part of the year. There are great lakes and rivers in the West which afford means of internal communication in summer for a vast area of country, while British Columbia has also a number of navigable rivers, and its extensive coast abounds in great harbours. A great part of the Arctic coast is usually obstructed by ice, but there is reason to believe that communication could be maintained between the mouth of the Mackenzie river and the Pacific ocean by way of Behring strait for a considerable portion of the year. Navigation on the interior waterways is obstructed in many places by waterfalls, but short canals overcome the difficulty and the waterfalls afford electric light and power for traction and manufacturing purposes. Canada already has an extensive system of canals and others are projected.

THE CLIMATE OF CANADA.

Climate depends as much upon local influences as upon latitude. The elevation, the character of surrounding waters and the prevailing winds must be taken into consideration. Thus while the climate of northwestern Europe is moderated by the Gulf Stream the Arctic current chills the coast of Labrador, but only a small portion of British North America suffers from this disadvantage. The greater part of Canada is particularly favoured by local surroundings, which can best be explained by describing the different provinces and territories separately. In studying the winter temperatures given in descriptions of the different sections of the country it should be noted that the minimum temperatures recorded are seldom experienced and never last more than a few hours at a time, usually during the night or early in the morning. When the thermometer registers below zero the atmosphere is usually very dry, clear and full of ozone. The cold seldom chills the body. Newly arrived immigrants from England who have the climatic conditions of the old land fresh in the memory nearly all agree that the cold of Canada in winter is far less disagreeable than that of the British Isles. Generally the temperatures are lower in winter and higher in summer than in the same latitudes of Europe, but this is not the case along the Pacific seaboard, where the winters are milder than in the same latitudes of Europe, the warm waters of the Japanese current having an influence upon the climate of the Pacific coast exactly opposite to that of the Arctic current upon the climate of Labrador.



The Plaza, Ottawa, Capital of Canada, showing the Chateau Laurier, the Central station, the post office and part of the Parliament Buildings.

SIX GREAT DISTRICTS.

Geographically and economically it is customary to divide the Dominion of Canada into six great districts: The Maritime Provinces, including Prince Edward Island, Nova Scotia and New Brunswick; Central Canada including Quebec and Ontario; the Prairie Provinces including Manitoba, Saskatchewan and Alberta; the Pacific coast province of British Columbia; the Yukon Teritory to the north of British Columbia; and the Northwest Territories, north of the Prairie Provinces.

THE POPULATION OF CANADA.

The population of Canada at the census taken in the spring of 1911 was 7,206,643. For the four years ending with 1914 the number of immigrants was 1,452,631, so that including the natural increase of population by excess of births over deaths the population of Canada was upwards of eight millions at the close of the year 1914. The population by provinces in 1911 was: Ontario, 2,523,274; Quebec, 2,003,232; Nova Scotia, 492,338; New Brunswick, 351,889; Prince Edward Island, 93,728; Manitoba, 455,614; Saskatchewan, 492,432; Alberta, 374,663; British Columbia, 392,480; Yukon, 8,512; Northwest Territories, 18,481. Over 97 per cent of the population were Europeans or of European descent. Those of British origin numbered 3,896,985 and those of French origin, 2,054,890. Those of French origin are largely concentrated in the province of Quebec and the sections of Ontario and the Maritime Provinces bordering on Quebec province. The French-Canadians while retaining their own language acquire the English language with great facility and in the cities and towns a large percentage of them speak English fluently. The descendents of the aboriginal inhabitants of Canada are known as Indians. They numbered 105,492 in 1911 and there were about twenty-five thousand of mixed blood known as half-breeds. Nearly all the Indians and half-breeds live on large reservations. They seldom mingle with the general population and are not often seen by visitors passing through Canada. The negro population of Canada in 1913 including those of mixed blood numbered 17,437, while there were 17,312 Chinese, 4,738 Japanese, 2,342 East Indians and 1,681 Turks.

CANADA AND THE UNITED STATES.

As Canada and the United States lie alongside each other from the Atlantic ocean to the Pacific it is interesting to note some of the important differences between them. The coast lines of the United States are much straighter than those of Canada, having comparatively few indentations. The Canadian coast lines on both oceans abound in gulfs and bays which make feeding and breeding places for fish and afford havens for fishermen, giving Canada the most extensive sea fisheries of any country in the world. Excepting the great lakes, which are shared in common by the two countries, the United States has very few lakes. Canada has almost innumerable lakes well supplied with fish. The great lakes which carry a large part of the commerce of both nations have their outlet through the St.

Lawrence river, running for over a thousand miles through Canada before it reaches the ocean. This fact must be regarded as of great commercial importance when it is remembered that some of the greatest cities of the United States including Chicago, Milwaukee, Detroit, Cleveland, Toledo and Buffalo are located on these lakes. The United States has no coal on either the Atlantic or Pacific seaboard, but has great quantities of coal in the interior. Canada has large coal areas on both its eastern and western seaboards and mining operations are carried on under the ocean as well as under the land, while the central provinces of Ontario and Quebec lack coal. Canada and the United States share the great Niagara water-power, but Canada has many other great water-powers and the central provinces that have no coal are especially favoured as regards cheap hydro-electric power, which has sometimes been called "white coal" owing to the white foam on the waterfalls and rapids from which the power is generated. Nearly the whole of the western half of the United States is very highly elevated. A scientific writer comparing the general altitude of the Western States with that of Europe described the Western States as a huge knob on the face of the earth. This high elevation is one reason why sections of the Western States much farther south than the most southern countries of Europe often have severe winter weather. The elevation of the states bordering on Western Canada is much lower than that of the states just south of them and after the Canadian border is crossed the country slopes steadily northward to the Arctic ocean.

THE COUNTRY OF THE TWENTIETH CENTURY.

It has been said that Canada will be the country of the twentieth century just as the United States was the country of the nineteenth century as regards rapid increase of population and development of natural resources. In the year 1810 the population of the United States was 7,239,881 as compared with Canada's population of 7,206,643 in 1911. The population of the United States at the close of the last century was over 75,000,000. There is reason to believe that Canada's population will be seventy-five millions long before the close of the twentieth century. In the early days of settlement in the United States the population of the British Isles and continental Europe was very much less than now and the emigration from those countries was necessarily less than at the present time. Emigrants from Europe had to cross the Atlantic in slow-going sailing vessels whereas they now have the accommodation of fast steamships. The United States had no well-settled neighbouring country from which to draw settlers. Canada received from the United States in 1914 over 107,000 settlers and as the great Republic to the south of Canada becomes more densely populated the influx of American settlers looking for new opportunities in the Canadian land of promise will steadily increase.

IMMIGRATION OF CANADA AND THE UNITED STATES.

The total immigration of Canada was 402,432 in the year 1913 and 384,878 in 1914. It was not until the year 1842 that immigration to the United States passed the 100,000 mark. In no year prior to 1850 did it reach 300,-

000. A very small number of immigrants arrived in the United States during the first quarter of the nineteenth century. In the year 1825 the immigrants numbered 10,199. During the next five years the annual immigration averaged 20,587. For the last seven decades of the nineteenth century the immigration was as follows:—

1831-1840	599,928
1841-1850	1,713,257
1851-1860	2,577,580
1861-1870	2,278,625
1871-1880	2,812,191
1881-1890	5,245,613
1891-1900	3,844,420

During the ten years ending with 1914 the total immigration to Canada was 2,530,799 as compared with 2,577,580 arriving in the United States during the decade ending with 1860, when the United States had a population of 31,443,321. During the decade ending with 1870, when the United States had a population of 38,558,371 the immigration was over 250,000 less than the immigration to Canada during the decade ending with 1914, when the population of Canada did not exceed nine millions. For the decade ending with 1880, when the population of the United States was 50,155,783, the immigration to the United States averaged only 28,139 more annually than the Canadian average for the ten years ending with 1914. These figures have great significance in considering the probable growth of Canada during the twentieth century. The development of the United States in the nineteenth century was regarded as more marvellous than that of any other country in the world's history, but the percentage of growth of Canada since the beginning of the twentieth century has been far greater than that of the United States in any period of equal length during the last century.

The commerce of the United States only amounted in value to $991,896,889 in the year 1870, when the population was 38,558,371. In 1880, when the population of the United States was 50,155,783, the inports were valued at $667,954,746, as compared with Canada's imports of $692,032,392 in the fiscal year 1913 and $650,746,797 in the fiscal year 1914. Thus Canada's trade is already worth as much to the other nations as that of the United States was when the population was over fifty millions.

EVIDENCES OF RAPID GROWTH.

There are many evidences of rapid growth since the beginning of the twentieth century. Comparing the year 1900 with the year 1914 the number of letters and postcards mailed in the latter year was more than three and a half times as great, the postal money orders being over six times as great in number and value, the number of passengers transported by steam railways more than twice as great, and the number transported by electric railways more than five times as great; nearly three times as much freight was carried by steam railways and more than six times as much by the electric railways, while over seven times as much freight passed through Canadian canals; there was nearly three and a half times as much fire insurance at risk and nearly three times as much life insurance in force; the bank deposits amounted to nearly three times as much

and the external trade was nearly three times as great. The figures for 1900 and 1914 were as follows:—

	1900.	1914.
Letters and postcards mailed..	205,422,500	737,638,000
Passengers carried by steam railways	21,500,175	46,702,280
Tons of freight carried by steam railways	35,946,183	101,393,989
Passengers carried by electric railways	*120,934,656	614,709,819
Tons of freight carried by electric railways..	* 287,926	1,845,023
Tons of freight passing through canals	5,013,693	37,023,237
Net amount of life insurance in force..	$431,069,846	$1,242,160,478
Number of postal money orders issued	1,074,922	7,227,964
Value of postal money orders issued..	$16,209,069	$109,500,670
Average amount of deposits in chartered banks, exclusive of Government deposits..	$305,140,242	$1,002,830,575
Canadian exports..	$191,894,723	$478,997,928
Canadian imports..	$189,622,513	$650,746,797

* The year 1901 is the first year for which electric railway statistics are available.

FARM PRODUCTION.

All fruits, grains and vegetables of the northern zone thrive in Canada, but the climatic conditions vary so much in a country so vast that the products that are most successful in one section may not be well suited to another section. Thus while the provinces of Manitoba, Saskatchewan and Alberta produce the finest wheat in the world they can grow only the hardiest fruits. In all the other provinces plums, pears, cherries and apples of the finest quality are produced; while in southern Ontario and British Columbia peaches and other delicate fruits of the temperate zone grow to perfection.

The provisional estimate of the principal grain crops of Canada in 1915 published by the *Census and Statistics Monthly* for October was as follows:—

	Bushels.
Wheat..	336,258,000
Oats..	481,035,500
Barley..	50,868,000

The largest yields of cereals in any year prior to 1915 were in 1913, when the combined yield of wheat, oats and barley was about three times as great as it was in the year 1900. The production in 1913 was as follows:—

	Bushels.
Wheat..	231,717,000
Oats..	404,669,000
Barley..	48,319,000
Rye..	2,300,000
Buckwheat..	8,626,000
Indian corn..	16,772,600

In the year 1914 the field crops were valued at $638,580,300. This amount represented the yield of 33,436,000 acres. The total land area of the Dominion is over sixty-eight times as great as the acreage from which these crops were gathered. What proportion of the total area is suitable for cultivation is a matter for conjecture, but it is certain that the area at present under cultivation is a very small fraction of the total. There

is no complete record of the values of other farm products since the census of 1911, when the values of the previous year's products other than field crops were estimated as follows:—

Vegetables	$ 20,581,204
Fruit and nursery stock sold	13,462,432
Milk and cream	117,589,495
Home-made butter and cheese	30,280,608
Eggs	23,501,173
Honey and wax	823,627
Maple sugar and syrup	2,570,283
Animals slaughtered on farms	27,678,646
Live stock sold in year	151,316,905

The factory-made cheese, butter and condensed milk, valued at $39,047,840, were included among manufactured products in the census returns.

FOREST WEALTH.

The Forestry Branch of the Department of the Interior estimates that Canada has between five and six hundred million acres of forest and that nearly three hundred million acres are covered with timber of merchantable size, including 100,000,000 acres in British Columbia, 100,000,000 acres in Quebec, 70,000,000 acres in Ontario, 11,000,000 acres in Manitoba, Saskatchewan and Alberta, 9,000,000 acres in New Brunswick and 5,000,000 acres in Nova Scotia. With a view to ensuring a future supply of timber, maintaining sources of water supply and protecting wild animals and birds from extermination, 152,833,955 acres of lands have been set aside as permanent forest reserves, including 107,997,513 acres in Quebec province, 14,430,720 acres in Ontario, and 2,474,240 acres in British Columbia under control of the provincial governments and 27,931,482 acres in the four western provinces under Dominion control. On the eastern slope of the Rocky mountains in Alberta there is a reserve of 11,656,320 acres, which will be of immense value in preserving the sources of many rivers which flow through the great Western Plain. The Forestry Branch estimated the value of forest products in the year 1914 at $176,672,000, approximately.

THE VALUE OF THE FISHERIES.

The future value of the fisheries will depend largely upon the amount of capital invested and the number of men employed in catching, curing and preserving fish. The value of fish and marine animals taken during the fiscal year 1914 amounted to $33,207,748.

SKINS AND FURS OF WILD ANIMALS.

According to the census of 1911 the skins and furs of wild animals killed in Canada in 1910 were valued at $1,927,450, the animals killed including 121 badgers, 859 black bears, 55 brown bears, 21 grizzly bears, 28 white bears, and 3,546 bears not specified, 24,895 beavers, 2,082 caribou, 735 coyotes, 2,726 deer, 1,018 elk, 52,072 ermine (weasels), 3,429 fishers, 46 black foxes, 6 blue foxes, 1,634 cross foxes, 9,610 red foxes, 475 silver foxes, 2,343 white foxes, 3,475 foxes not specified, 61 grampus, 8,159 lynx, 31,437

martens, 45,973 minks, 2,336 moose, 38 musk-ox, 915,744 muskrats, 5,721 otters, 22 panthers, 3,879 rabbits, 5,042 raccoons, 14,681 skunks, 282 squirrels, 5,108 fur seals, 235 walrus, 16 whales, 2,334 wolves and 927 wolvereens, besides a quantity of assorted furs valued at $445,320. According to the Trade and Navigation reports of the Customs Department the value of undressed furs exported during the fiscal year 1914 was $5,557,926 while the dressed furs exported were valued at $11,550. These figures would indicate that there has been a large increase in the production of furs since 1910, although it might be supposed that with the rapid settlement of the country the production of furs would decrease. However, there are still vast areas of Canada untouched by settlement. The setting aside of extensive areas of lands as forest reserves is having an important effect in conserving wild animals. It is expected that the production of furs bred in captivity by fur farmers in Prince Edward Island and other provinces will in a few years greatly increase the quantities of furs which Canada has for export, but as yet there is such a demand for animals for breeding purposes that the sale of skins is not large.

MINERAL RESOURCES.

The mineral resources of Canada have scarcely been touched as yet. The greater part of the Dominion has never been prospected. Even in the older districts very little development work has been done. The Canadian Geological Survey and the Mines Branch of the Department of Mines have done valuable exploration work. They have a number of very capable men at work and their reports are of great value in forming an estimate of the mineral resources of the Dominion, but the country is so vast that they can thoroughly examine only small portions of it and at best they can do little more than describe surface indications. The real value of mineral deposits can usually only be determined by costly development work which must be left to the enterprise of capitalists. In the past Canada has lacked capital and this has retarded the development of mineral resources. However, it has been established beyond doubt that Canada has in the province of Ontario the most valuable nickel deposits known to exist anywhere in the world, that the largest asbestos mines known are in the Canadian province of Quebec and at present supply the greater part of the world's consumption of asbestos, that the amber mica deposits of Ontario and Quebec are very extensive and are the only large supplies of this mineral known to exist outside of Ceylon, while Canada already ranks third among the silver producing countries of the world, the output of silver for the last five years being 157,122,362 ounces valued at $88,705,072. The production of silver in 1914 was 27,892,805 ounces valued at $15,288,324. Canada has always been a producer of gold. The smallest output in any one year since confederation was in 1892 when the production was 43,905 ounces valued at $907,601. The largest production in any one year was 1,350,000 ounces valued at $27,908,153 in the year 1900 when Klondyke gold mining reached its climax. In 1914 the production was 773,178 ounces valued at $15,983,000, the value of gold produced in Canada in 1914 being $695,000 greater than the value of silver produced. The total production of gold in Canada for the 48 years from 1867 to 1914 was 15,354,493 ounces valued at $316,760,110.

METALS RECOVERED FROM CANADIAN ORES.

No statistics showing the total value of mineral production in Canada are available. Statistics collected by the Mines Branch of the Department of Mines show the quantities and values of metals recovered from Canadian ores, but the refining of nickel and copper and to a large extent the lead and zinc has been done in the United States. The following table shows the quantities of metals recovered from Canadian ores in 1914:—

Gold	oz.	773,178
Silver	oz.	27,892,805
Nickel	lbs.	45,517,937
Nickel oxide	lbs.	392,512
Cobalt oxide	lbs.	899,027
Cobalt material, mixed Cobalt and nickel oxides	lbs.	2,079,001
Copper	lbs.	75,735,960
Lead	lbs.	36,337,765
Zinc ores	tons.	10,893

Small quantities of platinum, palladium and molybdenum were also recovered from Canadian ores. The quantity of zinc recovered from the 10,893 tons of ore is not stated. The quantity of iron ore exported was 60,410 tons while 95,744 tons of pig iron were made in Canada from Canadian ores.

NON-METALLIC MINERALS.

The quantities of non-metallic minerals produced in 1914 were as follows according to the statistics of the Mines Branch:—

Actinolite	tons.	119
Arsenious oxide	tons.	1,737
Asbestos	tons.	96,542
Asbestic	tons.	21,031
Chromite	tons.	136
Coal	tons.	13,637,529
Corundum	tons.	548
Feldspar	tons.	18,060
Fluorspar	tons.	Nil.
Graphite	tons.	1,647
Graphite artificial	tons.	617
Grindstones	tons.	3,976
Gypsum	tons.	516,880
Magnesite	tons.	358
Manganese	tons.	28
Mica		...
Mineral pigments—		
Barytes	tons.	612
Ochres	tons.	5,890
Mineral water		...
Natural gas	M. ft.	21,692,504
Peat	tons.	685
Petroleum	brls.	214,805
Phosphate	tons.	954
Pyrites	tons.	228,314
Quartz	tons.	54,148
Salt	tons.	107,038
Talc	tons.	10,808
Tripolite	tons.	650

STRUCTURAL MATERIALS AND CLAY PRODUCTS.

The quantities and values of structural materials and clay products produced in 1914 were as follows according to the statements of the Mines Branch:—

		Quantity.	Value. $
Cement, Portland	brls.	7,172,480	9,187,924
Clay products—			
Brick, common	No.	457,513,762	3,653,861
pressed	No.	93,634,858	1,115,556
paving	No.	2,707,000	49,627
moulded and ornamental	No.	1,554,496	23,592
Fireclay and fireclay products	No.	....	107,568
Fireproofing and architectural terra cotta		....	405,543
Kaolin	tons.	1,000	10,000
Pottery		....	35,371
Sewer pipe		....	1,104,499
Tile, drain	No.	....	366,340
Lime	bus.	7,028,582	1,360,628
Sand lime brick	No.	70,650,030	609,515
Sand and gravel		....	2,505,310
Slate	squares	1,075	4,837
Stone—			
Granite		....	2,176,602
Limestone		....	2,672,781
Marble		....	132,533
Sandstone		....	487,140

CANADIAN MANUFACTURING INDUSTRIES.

The manufacturing industries of Canada are making such rapid progress that the latest statistics available, those of the census of 1911, give an inadequate conception of the amount of capital invested in manufacturing and the value of the products at the present time. The census figures were as follows:—

Industries Grouped.	Establishments.	Capital Invested.	Value of Products.
	No.	$	$
Food products	6,985	133,044,523	245,669,321
Textiles	1,444	108,787,407	135,902,441
Iron and steel products	824	123,561,319	113,640,610
Timber, lumber and re-manufactures	4,999	259,889,715	184,630.376
Leather and its finished products	399	48,788,803	62,850,412
Paper and printing	773	62,677,612	46,458,053
Liquors and beverages	260	43,237,757	28,936,782
Chemicals and allied products	178	26.026,124	27,798,833
Clay, glass and stone products	771	45,859,507	25,781,860
Metals and metal products other than steel,	341	67,133,540	73,241,796
Tobacco and its manufactures	173	21,659,935	25,329,323
Vehicles for land transportation	465	49,397,096	69,712,114
Vessels for water transportation	172	10,351,765	6,575,417
Miscellaneous industries	1,011	235,148,103	104,618,560
Hand trades	423	11,120,403	14,829,741
Totals	19,218	1,247,583,609	1,165,975,639

It is noteworthy that the value of one year's manufactured products is very nearly equal to the total amount of capital invested.

EDUCATIONAL INSTITUTIONS.

Education is under provincial control and in every province there is a system of free public schools, high schools, normal schools, and universities. Visitors to Canada are always impressed with the fine school buildings in every city, town and village, and even in the rural districts. The newest settlements are supplied with good schools. There are twenty-one universities in the Dominion. The standard of education in law and medicine is very high in all the provinces. The University of Toronto and McGill University, Montreal, may be said to rank among the world's great universities. They are especially noted for their applied science and medical courses. Their chemical, metallurgical, mechanical and electrical equipment is unsurpassed in America, and the instruction in architecture, civil engineering, mining engineering, electrical engineering, analytical and applied science is very thorough. The Royal Military College, Kingston, Ontario, gives a very complete course in engineering and all branches of military science; a number of its graduates have distinguished themselves in the British army. The newly-established Royal Naval College at Halifax is intended to serve the same purpose in training naval officers. In Kingston, Ontario, there is a School of Mining.

The technical education of industrial workers was for a long time neglected, but in recent years important advances have been made. Toronto has now one of the largest and best equipped technical schools in America, with branches in different parts of the city. Technical and industrial schools have been established in a number of other manufacturing cities of Ontario, and recent legislation in that province provides for technical courses at the high schools. In Nova Scotia besides the Nova Scotia Technical College at Halifax there are technical schools in Truro, Amherst, Yarmouth, New Glasgow, and Sydney, and a number of coal mining schools. The great French Canadian University of Laval, which has colleges in both Montreal and Quebec city, not only has a high standing in the teaching of languages and law, but maintains polytechnical schools in both cities. Montreal has also a technical high school. In Winnipeg there are two technical schools. A Royal Commission appointed by the Dominion Government to investigate the whole question of technical education recently made a report recommending a large Government expenditure for the encouragement of technical schools. There are a number of commercial schools in cities and towns throughout the Dominion.

AGRICULTURAL COLLEGES AND EXPERIMENTAL FARMS.

The Ontario Agricultural College at Guelph has now an international reputation and there are students in attendance not only from every province in the Dominion but also from many other countries. Macdonald College, Ste. Anne de Bellevue, Quebec, is another great agricultural school. It is incorporated with McGill University, Montreal. There is a very good agricultural college at Truro, Nova Scotia. The Manitoba Provincial Agricultural College in Winnipeg and the Saskatchewan Prov-

incial Agricultural College at Saskatoon give instruction in all branches of agricultural science. All these agricultural colleges have large experimental farms in connection with them.

The Dominion Department of Agriculture maintains the Central Experimental Farm at Ottawa, main branch farms at Nappan in Nova Scotia, near the New Brunswick boundary, at Brandon in Manitoba, at Indian Head in Saskatchewan, and at Agassiz in British Columbia, besides subsidiary farms known as experimental stations at Charlottetown in Prince Edward Island, at Kentville in Nova Scotia, at Cap Rouge and Ste. Anne de la Pocatière in Quebec province, at Rosthern and Scott in Saskatchewan, at Lacombe and Lethbridge in Alberta, at Invermere on the British Columbian mainland, and at Sidney in Vancouver island. It is the policy to increase the number of experimental stations as rapidly as possible as different districts present different problems to settlers. The various lines of work undertaken by experimental farms have been outlined as follows: "Conducting researches and experiments designed to test the value for all purposes of different breeds of stock and their adaptability to the varying climatic and other conditions which prevail in the several provinces; examining into scientific and economic questions involved in the production of milk, butter and cheese; testing the merits, hardiness and adaptability of new or untried varieties of wheat and other cereals, and of all field crops, grasses and forage plants, fruits, vegetables, plants and trees; analyzing fertilizers and conducting experiments to test their comparative value; examining into the composition and digestibility of foods for various animals; examining into diseases to which cultivated plants and trees are subject and the ravages of destructive insects for the purpose of ascertaining the most useful preventatives and remedies; conducting experiments in the planting of trees for timber and for shelter and supplying farmers with young trees for these purposes. One of the most important branches of work has been the production by cross-breeding of new varieties of spring wheat of early ripening habit and suitable for the northern wheat-growing areas of Canada. Of the varieties which have proved useful in districts where the older standard wheats could not be depended upon to ripen before frost, the most noteworthy is the Marquis. This wheat comes from a cross between Hard Red Calcutta and Red Fife. After being tested for a few years at Ottawa, it was sent first to the Experimental Farm at Indian Head, Sask., for trial in the year 1907. From the very beginning it proved remarkably successful in Saskatchewan, and has since been found of great value in parts of Manitoba and Alberta also. Marquis is now recognized as the best early ripening wheat available for the farmers of Saskatchewan. Lecturers have been sent into the farming districts to make the farmers acquainted with the value of scientific agriculture. Great results were achieved in the development of cheese factories and creameries as a result of a campaign carried on under the direction of the Dairy Commissioner.

THE BANKING SYSTEM.

Canada's banking system is established on a very sound financial basis. There are twenty-two chartered banks. The leading banks have

branches in cities and towns throughout the Dominion. In the larger cities there are a number of branch banks to serve the convenience of the different districts. Altogether there are 3,192 branches of the chartered banks in Canada. The standing of the chartered banks as regards capital, reserve fund, and number of branches in Canada is shown in the following table:—

Name of Bank.	Capital Authorized.	Capital Subscribed.	Capital Paid-Up.	Reserve Fund.	No. of Branches.
	$	$	$	$	
Bank of Montreal	25,000,000	16,000,000	16,000,000	16,000,000	178
Quebec Bank	5,000,000	2,734,700	2,734,620	1,308,655	57
Bank of Nova Scotia	10,000,000	6,500,000	6,500,000	12,000,000	172
Bank of British North America	4,866,666	4,866,666	4,866,666	3,017,333	90
Bank of Toronto	10.000,000	5,000,000	5,000,000	6,000,000	116
Molsons Bank	5,000,000	4,000,000	4,000,000	4,800,000	96
Banque Nationale	5,000,000	2,000,000	2,000,000	1,700,000	196
Merchants Bank of Canada	10,000,000	7,000,000	7,000,000	7,000,000	209
Banque Provinciale du Canada	2,000,000	1,000,000	1,000,000	650,000	122
Union Bank of Canada	8,000,000	5,000,000	5,000,000	3,400,000	317
Canadian Bank of Commerce	25,000,000	15,000,000	15,000,000	13,500,000	377
Royal Bank of Canada	25,000,000	11,560,000	11,560,000	12,560,000	341
Dominion Bank	10,000,000	6,000,000	6,000.000	7,000,000	91
Bank of Hamilton	5,000,000	3,000,000	3,000,000	3,600,000	124
Standard Bank of Canada	5,000,000	3,000,000	3,000,000	4,000,000	123
Banque d'Hochelaga	4,000,000	4,000,000	4,000.000	3,700,000	136
Bank of Ottawa	5,000,000	4,000,000	4,000,000	4,750,000	98
Imperial Bank of Canada	10,000,000	7,000,000	7,000,000	7,000,000	126
Home Bank of Canada	5,000,000	2,000,000	1,945,260	666,666	47
Northern Crown Bank	6,000,000	2,862,400	2,858,589	150,000	113
Sterling Bank of Canada	3,000,000	1,266,400	1,197,237	300,000	49
Weyburn Security Bank	1,000,000	632,200	316,100	125,000	14
Total	188,866,666	114,422,366	113,978,472	113,227,654	3,192

The chartered banks are united in an association incorporated under the name of the Canadian Bankers' Association and the Bank Act of Canada provides for a system of co-operation between these banks under the direction of the Dominion Government. The most important feature of this co-operation is the establishment of a Note Circulation Guarantee Fund, officially called the Circulation Fund, controlled by the Canadian Government. The note circulation of each bank is restricted by law in proportion to its financial strength and each bank is obliged to deposit with the Government an amount of money equal to five per cent of its note circulation. In the event of the suspension of any bank and its failure to redeem its notes the Minister of Finance may pay out of the Note Circulation Guarantee Fund all unpaid notes with interest at the rate of five per cent from the date of suspension until the date fixed by the Government for payment, all payments from the Circulation Fund being made without regard to the amount contributed by the bank in respect of whose notes the payments are made. If the payments from the Circulation Fund exceed the amount contributed to the Circulation Fund by the bank suspending payment the other chartered banks must on demand of the Minister of

Typical Canadian Bank Buildings.

Finance make good the amount of the excess in proportion to their note issue, but no bank is called upon to make payment on this account in any one year of more than one per cent of the average amount of its note circulation in addition to the five per cent deposited with the Government for purpose of such payments. There are a number of other safeguards provided in The Bank Act to insure the stability of the banks. In addition to the restrictions imposed by law there is a general disposition on the part of all chartered banks to co-operate with each other through the Canadian Bankers' Association. Thus to a great extent the whole financial strength of the Canadian banking system stands behind the small branch banks in every little town throughout the country.

Outside of Canada the Bank of Montreal, the Canadian Bank of Commerce, the Royal Bank of Canada, the Dominion Bank, the Bank of British North America, and the Union Bank of Canada have branches in London, England, while La Banque National has a branch in Paris, France. In Newfoundland the Bank of Nova Scotia has 13 branches, the Royal Bank of Canada 3, the Bank of Montreal 3, and the Canadian Bank of Commerce 1. In the British West Indies the Royal Bank of Canada has 3 branches in British Guiana, 2 in Trinidad, 1 in Barbados, 1 in Dominica, 1 in St. Kitts, 1 in Antigua and 1 in Jamaica; the Bank of Nova Scotia has 8 branches in Jamaica and one in the Bahamas. In Cuba the Royal Bank of Canada has 21 branches and the Bank of Nova Scotia one. In Porto Rico the Royal Bank of Canada has 4 branches and the Bank of Nova Scotia one. In the Dominican Republic the Royal Bank of Canada has two branches. In the City of Mexico the Bank of Montreal and the Canadian Bank of Commerce have branches. In the United States the Bank of Nova Scotia has branches in New York, Boston and Chicago; the Bank of Montreal in New York, Chicago and Spokane, Wash.; the Canadian Bank of Commerce in New York, Portland, Oregon, Seattle, Wash., and San Francisco, Cal.; the Bank of British North America in New York and San Francisco, Cal.; the Merchants Bank of Canada in New York; and the Royal Bank of Canada in New York.

GROWTH OF CANADIAN TOWNS.

The urban population of Canada is not concentrated in one or two great cities. At the census of 1911 there were four towns with over 100,000; three with over 50,000, all three of which have since passed the 100,000 mark; four with over 40,000; two with over 30,000; two with over 20,000; eleven with over 15,000; eighteen with over 10,000; twelve with over 8,000; eight with over 5,000; seventeen with over 4,000; forty-two with over 3,000; sixty-nine with over 2,000; seventy-four with over 1,500; and 104 with over 1,000. In the following table the estimated population of forty-three towns having a population of 12,000 or over early in 1915 is compared with the population according to the Dominion Census in 1901 and 1911. The estimates of population were furnished by the city clerks and in the majority of cases represent the estimates made by city assessors in the autumn of 1914. As there has been little increase of population since the outbreak of war the estimates made in 1914 may be considered approximately correct for 1915. In some of the western towns there may have been slight

decreases during the war which are of course only temporary. The terms "Greater Montreal," "Greater Winnipeg," "Greater Vancouver," mean these cities and the suburban towns which are merely outgrowths of the cities. The suburban extensions of the city of Montreal on the island of Montreal have a population of over 100,000, while the towns of St. Lambert and Longueuil on the opposite shore of the St. Lawrence river are mere residential suburbs of Montreal. Vancouver's growth since the census of 1911 has been chiefly in suburban towns and Winnipeg has also populous suburbs. Toronto has annexed all its important suburbs, but there are several contiguous villages still outside the limits. According to the estimate of city assessors in 1914 Toronto's population was 470,144, but according to the estimate of the Toronto City Directory for 1915 it was 534,000.

	Census 1901.	Census 1911.	Estimate for 1915.
Montreal City	267,730	470,480	617,000
Greater Montreal	......	......	717,000
Toronto	208,040	376,538	534,000
Winnipeg	42,340	136,038	212,889
Greater Winnipeg	......	......	273,047
Vancouver	27,010	100,401	106,110
Greater Vancouver	......	......	197,283
Hamilton, Ont.	52,634	81,969	102,000
Ottawa, Ont.	59,928	87,062	101,795
Quebec City, Que.	68,840	78,710	100,000
Calgary, Alta.	4,392	43,704	75,000
Edmonton, Alta.	2,626	24,900	59,339
Victoria, B.C.	20,919	31,660	60,000
St. John, N.B.	40,711	42,511	58,000
London, Ont.	37,976	46,300	56,358
Halifax, N.S.	40,832	46,619	55,000
Regina, Sask.	2,249	30,213	50,000
Saskatoon, Sask.	113	12,004	25,000
Brantford, Ont.	16,619	23,132	26,389
Moosejaw, Sask.	1,558	13,823	23,000
Peterborough, Ont.	11,239	18,360	20,653
Windsor, Ont.	12,153	17,829	22,993
Sydney, N.S.	9,009	17,723	22,000
Hull, Que.	13,993	18,222	20,257
Kingston, Ont.	17,961	18,874	18,874
Three Rivers, Que.	9,981	13,691	20,000
Berlin, Ont.	9,747	15,186	19,056
Sherbrooke, Que.	11,765	16,405	19,310
Brandon, Man.	5,620	13,839	18,000
Fort William, Ont.	3,633	16,449	27,176
Port Arthur, Ont.	3,214	11,220	18,325
St. Catharines, Ont.	9,946	12,484	17,296
St. Thomas, Ont.	11,485	14,054	17,029
New Westminster, B.C.	6,499	13,199	17,198
Glace Bay, N.S.	6,945	16,562	17,000
Stratford, Ont.	9,959	12,946	17,500
Guelph, Ont.	8,856	14,579	16,799
Moncton, N.B.	9,026	11,345	15,000
Sault Ste. Marie, Ont.	7,169	10,984	12,397
Chatham, Ont.	9,068	10,770	12,714
Galt, Ont.	7,866	10,299	12,000
Charlottetown, P.E.I.	12,080	11,198	12,000
Niagara Falls, Ont.	5,702	9,248	12,000

RAILWAYS AND STEAMSHIP LINES.

All settled parts of Canada can be conveniently reached by railway and steamship lines. At the end of June, 1914, Canada had 36,655 miles of completed steam railways and 8,591 miles under construction. Includ-

ing double tracks, yard trackage and sidings the total mileage completed was 46,465 miles. In addition to the steam railways there were 2,000 miles of electric railways.

The Dominion Government owns the Intercolonial railway, the Prince Edward Island railway, the National Transcontinental railway, and the Hudson Bay railway. The Intercolonial railway extends from the Atlantic ports of Halifax, St. John, Sydney and North Sydney to Montreal, with many branch lines to different parts of Nova Scotia and New Brunswick. The total mileage is 1,489·77 miles, including 32 miles between Windsor Junction and Windsor, N.S., operated by the Dominion Atlantic Railway under lease. There are in addition about 482 miles of sidings and spurs and 26·09 miles of the main line is double tracked. The Prince Edward Island railway has a total length of 275·2 miles. Extending from Tignish to Georgetown and from Charlottetown to Murray Harbour, with branches to Souris, Elmira and Cape Traverse, it serves every part of the island province. The National Transcontinental railway is the Government section of the Grand Trunk Pacific railway. It extends from Moncton, N.B., to Lévis, opposite Quebec city, and from Quebec city to Winnipeg, where it connects with the Grand Trunk Pacific line from Winnipeg to Prince Rupert on the Pacific coast, which is operated by the Grand Trunk Pacific Railway Company. When the great Quebec bridge is completed across the St. Lawrence the National Transcontinental will cross it. The total mileage from Moncton to Winnipeg is 1,804·52 miles, including the Quebec bridge, which will be 1·1 mile in length, while the Grand Trunk Pacific between Winnipeg and Prince Rupert is 1,745 miles in length. The Government leases from the Grand Trunk Pacific Railway a branch line connecting Port Arthur on lake Superior with the National Transcontinental railway. At Moncton the National Transcontinental railway makes connection with the Intercolonial railway lines running to St. John and Halifax. The Hudson Bay railway under construction will extend from Port Nelson on Hudson bay to the Pas on the Saskatchewan, a distance of 418 miles.

The Ontario Government owns and operates through a commission a railway 334 miles long, extending from North Bay to Cochrane on the National Transcontinental railway and passing through the famous Cobalt silver district.

The Canadian Pacific Railway Company, including lines owned and leased, controls a mileage of 12,585 miles in Canada. The Canadian Pacific's transcontinental line extends from St. John, N.B., to Vancouver, B.C., a distance of 3,376·7 miles. For a distance of nearly 177 miles this Canadian Pacific line runs across a section of the state of Maine that juts into Canada, and this fact has often been made the foundation for statements to the effect that the Canadian winter ports in the Maritime Provinces cannot be reached by railway from the central provinces of Canada without passing through the United States. Shortly after the outbreak of the German war a statement that Canadian soldiers would be unable to reach Atlantic ports by railway because they would not be allowed to pass through the United States was published in many countries. As a matter of fact there are three all-Canadian railway routes between Quebec province and New Brunswick, viz., the Intercolonial rail-

way, the National Transcontinental railway, and the Temiscouata railway, which running from Rivière du Loup, in the province of Quebec, to Edmundston, in New Brunswick, makes connection there with a Canadian Pacific Railway line running down the St. John River valley to St. John. The Dominion Atlantic railway in Nova Scotia now belongs to the Canadian Pacific railway.

The Grand Trunk Railway Company in addition to controlling the Grand Trunk Pacific railway in Western Canada has in Ontario and Quebec 3,562·39 miles, besides 707 miles of double track and 1,224 miles of yard tracks and sidings, making a total of 5,493·39 miles.

The Grand Trunk and Canadian Pacific Railways own extensive mileages in the United States. Both these Canadian railways run through trains from Montreal to Chicago by way of Toronto.

The Canadian Northern had in 1914 about 4,896 miles in the four western provinces, while in Ontario and Quebec the lines owned and controlled by the Canadian Northern had a mileage of about 2,014 miles. The Canadian Northern Railway line from Quebec and Montreal to Vancouver, B.C., is nearly completed. Trains now run from Toronto to Vancouver. The same interests that control the Canadian Northern Railway lines also own the Halifax and Southwestern Railway and the Inverness Railway and Coal Company in Nova Scotia.

Besides the railway lines controlled by the Canadian Pacific, Grand Trunk and Canadian Northern railways, there are a number of lines owned by other companies, but none of them have extensive mileage. The Canada Southern railway, extending across the southwestern peninsula of Ontario, is controlled by the Michigan Central Railway.

The Canadian Pacific Railway Company runs large passenger steamers between Owen Sound, on Georgian bay, and Fort William, on lake Superior. Any one travelling to the western provinces has the option of going all the way by rail or breaking the monotony of the journey by a steamship trip across the great fresh-water seas, lake Huron and lake Superior. There are other lines of steamers making connection with all the important lake ports. Passenger steamers run daily from Toronto to the Niagara river, where they make connection with Niagara Falls by electric railway. A visitor may cross the lake to Niagara and return from Niagara Falls to Toronto by railway. Comfortable passenger steamers run from Hamilton and Toronto through lake Ontario and down the St. Lawrence river to Montreal, passing the Thousand islands and running the famous Lachine rapids. Pleasure trips may be taken on small steamers running on the Ottawa river and through the Rideau canal, river and pretty lakes. From Montreal passenger steamers run down the St. Lawrence to Quebec and the Saguenay river, and there are also passenger steamers connecting Montreal with Nova Scotia, New Brunswick and Prince Edward Island. In the Maritime Provinces there are local steamship lines by which one may reach all the important seaports of these provinces. River steamers run on the important New Brunswick rivers. In the Prairie Provinces there are small steamers navigating the Red river, lake Winnipeg and the Saskatchewan river, and there is a regular steamer service down the great Mackenzie river to Fort McPherson, within a few miles of the Arctic ocean. In British Columbia

there are steamers running on many of the navigable lakes and rivers in the interior, while there are regular lines of steamers running from Vancouver and Victoria to all important points along the Pacific coast of Canada and the United States.

While many of the steamers plying on the lakes and rivers of Canada carry both passengers and goods there are large numbers employed exclusively in the transportation of freight. The fact that 37,023,237 tons of freight passed through Canadian canals in 1914 is an indication of the importance of Canadian water traffic, but very large quantities of goods carried on lake and river steamers do not pass through any canal.

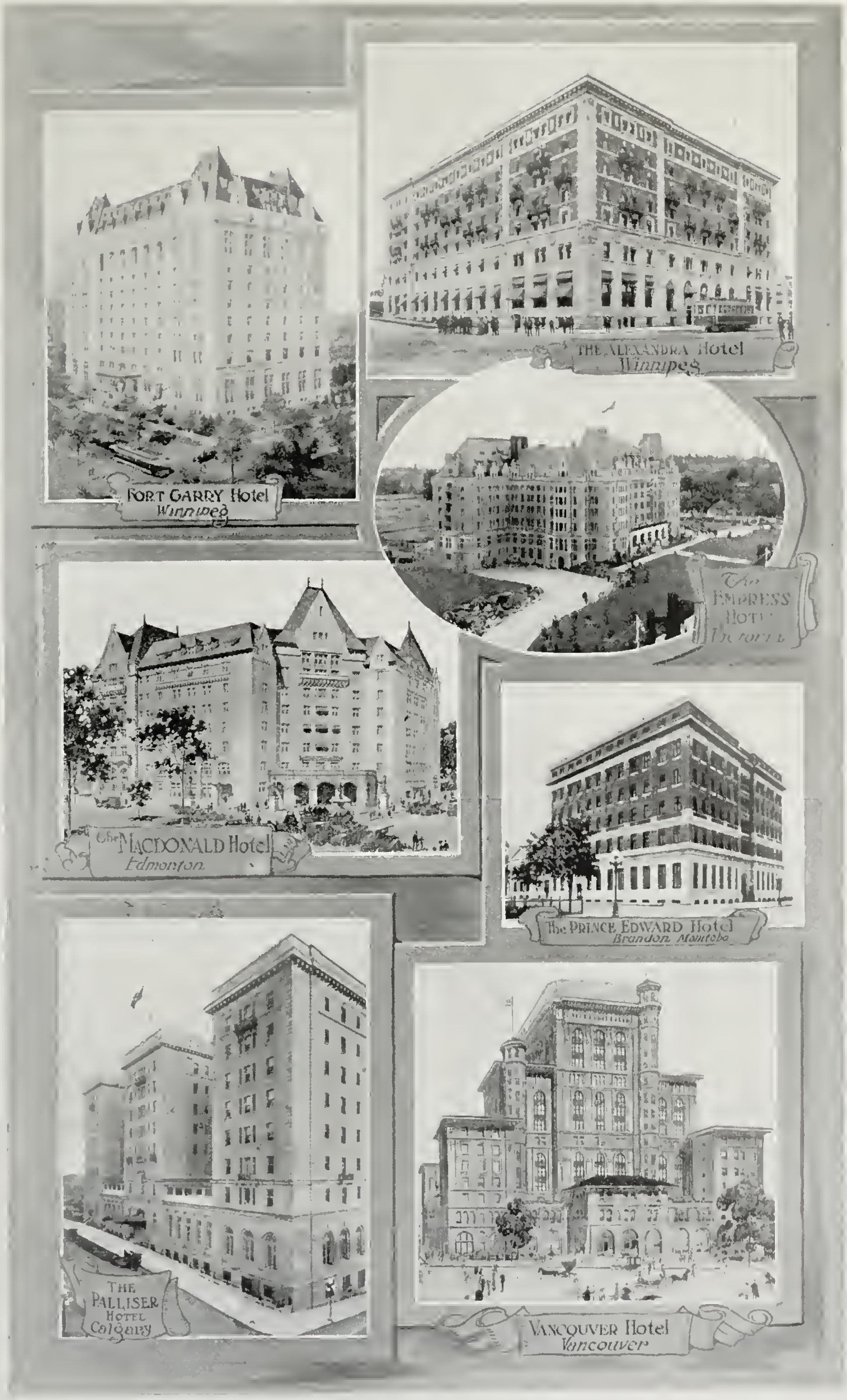
An illustration of the great value of Canada's internal system of waterways may be found in the fact that although the Canadian Pacific Railway company has its own rails from ocean to ocean with branches in every direction connecting with almost every section of settled Canada it makes use of lake steamers very extensively in the transportation of grain and other freight during the season of lake navigation. It goes to the expense of constructing great grain elevators at Fort William and Georgian Bay ports and the grain is transferred from cars to elevators and from elevators to steamships at Fort William, to be carried across the lakes to Georgian Bay ports where it is again transferred to railway cars running down to Montreal. All this expense of trans-shipping grain is considered worth while in order to take advantage of the water route by which freight can be transported so much more cheaply than by rail. The other railways follow the same policy having their own elevators and ships.

There are exact records of Canada's trade with other countries for every year since confederation and the figures show extraordinary progress, but there is no record of the interprovincial trade, which makes up the great bulk of freight carried on the railways and waterways of Canada. Some idea of the immensity of this interprovincial trade can be obtained by comparing the total production of farm products, fish, forest products and manufactures with the exports of such products. As nearly every Canadian province is larger than important countries of Europe to show the real business activity of the Canadian people as compared with European nations it would be necessary to add the interprovincial trade to the outside trade.

DETAILED INFORMATION.

Details regarding climate, agricultural capabilities, forest areas, and mineral resources will be found in the chapters of this volume describing the various provinces and territories, while special chapters are devoted to the water-powers, the fisheries, the farm food products, the forest products and the general manufactures of Canada.

Great hotels in eastern cities.



Great hotels in western cities.

A Group of Railway Buildings.

Chapter II.

THE MARITIME PROVINCES AND THE WORLD'S MARKETS.

Few Canadians as yet realize the great natural resources of the Maritime Provinces and the wonderful geographical advantages they possess for a world-wide commerce. These provinces have the same geographical relation to the continent of North America that the British Isles have to the continent of Europe. They jut out into the Atlantic far to the east of North America just as the British Isles lie out in the Atlantic to the west of Europe. The area is nearly as great as that of England and Wales, and if Newfoundland be included the area is a little greater than that of England, Wales and Scotland. The Maritime Provinces might also be compared with the New England States of the American Union. Including Newfoundland the area of the Maritime Provinces is 93,897 square miles, as compared with 66,424 square miles of the New England States having a population of about 6,600,000. Excluding Newfoundland and Maine we may compare Prince Edward Island, Nova Scotia and New Brunswick, having an area of 51,163 square miles and a population of 937,955 in 1911 with Massachusetts, Rhode Island, Connecticut, New Hampshire and Vermont having an area of 32,110 square miles and a population of about 5,800,000. The New England States have no coal, few other minerals and not very extensive areas of fertile land.

The Maritime Provinces of Canada have great mineral resources, extensive forests, considerable areas of fertile agricultural lands and most valuable fisheries. The climate is particularly healthy and invigorating and the people of these provinces have a most remarkable record of longevity. According to the census of 1911 with a total population of 937,955 the Maritime Provinces of Canada had 43,135 persons seventy years and over, 12,842 persons eighty years and over, 1,202 ninety years and over and 33 one hundred years and over. The annual death rate among all classes is very low. The climate is as favourable to live stock as to men. The managers of the leading cloth factories and knitting mills of Canada agree that the finest wool produced in Canada is grown in the Maritime Provinces and especially in the province of Nova Scotia. The fact that the resources of the Maritime Provinces have been comparatively neglected while other parts of the continent have been developed should not be a reason for discouragement regarding the future of these provinces. The British Isles were undeveloped and had but a small population at a time when some of the countries of continental Europe were rich and populous centres of industry and commerce.

A WATER ROUTE TO THE WEST.

The long railway distance from the Maritime Provinces to Western Canada has been a serious handicap and consequently the manufacturers of these provinces have been at a disadvantage in competing with those of Ontario and Quebec for the trade of the rapidly growing West.

In discussing the possibilities of the navigation of Hudson strait and bay the only thought in the West has been that it would be a short route between England and Western Canada, but if navigation of the strait and bay should prove to be safe and certain for even three months of the year, large ships running from St. John and Halifax to Port Nelson, the terminus of the Hudson Bay railway now being constructed by the Canadian Government, could lay down goods from Nova Scotia and New Brunswick in the heart of Western Canada at comparatively low cost for transportation.

ADVANTAGEOUS GEOGRAPHICAL SITUATION.

The advantageous geographical situation of the Maritime Provinces of Canada for commercial purposes will be understood when Halifax and St. John, the leading seaports, are compared with Liverpool as regards distances from the leading markets of the world by water routes for full-powered steamships. The distances are as follows:—

Miles from Halifax.	Miles from St. John.	Miles from Liverpool.	To
872	1,116	2,762 *via* Belle Isle.	Montreal.
599	560	3,071	New York.
3,558	3,676	4,065	Pernambuco, Brazil.
4,630	4,748	5,138	Rio Janeiro "
5,731	5,849	6,232	Buenos Ayres, Argentine.
1,810	1,810	4,049	Kingston, Jamaica.
1,900	1,955	3,627	Barbados, B.W.I.
a 2,091	*a* 2,123	3,831	Port-of-Spain, Trinidad.
2,290	2,345	3,936	Georgetown, British Guiana.
2,425	2,381	4,823	Vera Cruz, Mexico.
1,614	1,570	4,116	Havana, Cuba.
2,308	2,308	4,544	Colon, Entrance to Panama Canal.
4,968	4,968	7,204 *via* Panama.	Valparaiso, Chili.
10,289	10,289	12 525 " Panama. .	Melbourne, Australia.
12,428	12,659	11,015 " Suez. . . .	Melbourne, Australia.
12,899	13,017	13,406 " Horn	Melbourne, Australia
12,319	12,488	11,900 " Cape. .	Melbourne, Australia.
3,829	8,829	11,065 " Panama. .	Wellington, New Zealand.
11,439	11,557	11,946 " Horn. . . .	Wellington, New Zealand.
13,803	14,034	12,395 " Suez. . . .	Wellington, New Zealand.
5,603	5,603	7,839 " Panama. .	San Francisco, Cal.
13,000	13,118	13,497 " Magellan.	San Francisco, Cal.
6,444	6,444	8,680 " Panama. .	Vancouver, B.C.
10,018	10,018	12,254 " Panama. .	Yokohama, Japan.
12,490	12,721	11,082 " Suez. . .	Yokohama, Japan.
10,754	10,754	12,990 " Panama. .	Vladivostock, Russia.
12,710	12,941	11,302 " Suez. . . .	Vladivostock, Russia.
11,732	11,732	13,968 " Panama. .	Hong Kong.
11,060	11,291	9,652 " Suez. . . .	Hong Kong.
6,484	6,654	6,067	Cape Town.
14,574	14,574	16,810 " Panama. . .	Calcutta.
9,277	9,508	7,869 " Suez. . . .	Calcutta.
4,475	4,706	3,067	Constantinople.
2,685	2,916	1,277	Gibraltar.
2,785	3,031	726	Amsterdam.
2,565	2,811	512	Havre.
5,617	5,735	6,123	Montevideo.
2,761	3,007	699	Antwerp.
3,365	3,596	1,957	Marseilles.

a Via St. Thomas.

NOTE.—These distances represent sailing routes for full-powered steamships. There is a little variation in routes taken by different steamship lines, but the difference is not great unless calls are made at intermediate ports. Slight variations will be found in all published tables of distances, but the differences are not great enough to affect this comparison.

As regards raw materials for manufacture that must be imported, Halifax and St. John are nearer the raw cotton of the Southern States, the cane sugar of the West Indies, the rubber of Brazil and British Guiana, the wool of Australia and New Zealand, and the hides of the Argentine Republic, than Liverpool is. Of course Liverpool has the advantage of first-class steamship connection with all the leading ports of the world, which St. John and Halifax have not yet secured, and short routes for steamships are of little advantage unless there are steamships running on the routes, but the conditions in this regard are likely to greatly improve at Halifax and St. John in the future.

THE ISLAND OF NEWFOUNDALAND.

Newfoundland, the sentinel island of British North America, has not yet joined the Canadian confederation. Stretching across the front of the gulf of St. Lawrence it almost makes a lake of it for the strait of Belle Isle between Newfoundland and Labrador is only ten miles wide at its narrowest part, while the strait of Cabot, separating Newfoundland from Cape Breton in Nova Scotia, is fifty-six miles wide at its narrowest point, and the distance from Port-aux-Basque, the western terminus of the Newfoundland railway, to Sydney, Cape Breton, is 110 miles. Newfoundland has an area of 42,734 square miles, with an extreme length of about 317 miles from north to south and about 316 miles from east to west. The great majority of the population are supported directly or indirectly by the fisheries, but there are vast forests, and lumbering operations are carried on quite extensively, while the manufacture of wood pulp and paper is becoming an important industry. Very little exploration work for minerals has been done, but quite important copper deposits have been discovered, coal of good quality in rather thin seams has been found, and iron ore is shipped in large quantities to the iron and steel works of Nova Scotia. Very little attention has been devoted to farming and a very small area is under cultivation, but it is believed that there is a great deal of land suitable for growing oats, barley, potatoes and other vegetables. The climate is not very severe in winter, the thermometer seldom going below zero, while the summer temperatures usually range from 70 to 80 degrees. The Newfoundland Government has jurisdiction over a little corner of Labrador fronting on Belle Isle strait and a narrow strip of its Atlantic seaboard, the total area being about 120,000 square miles. The population of the colony was 238,670 according to the census of 1911. The capital and commercial centre of the island is St. John's on the east coast. It is only 1,930 miles from Liverpool.

A Prince Edward Island farm.

A Prince Edward Island black fox.

Chapter III.

THE PROVINCE OF PRINCE EDWARD ISLAND.

Prince Edward Island, the smallest province of the Dominion, lies at the mouth of the gulf of St. Lawrence and is separated from the mainland of New Brunswick and Nova Scotia by Northumberland strait. It is 150 miles in length, varies in width from four to thirty miles, and has an area of 2,184 square miles or 1,397,991 acres, nearly all of which is suitable for cultivation, but it is estimated that only a little more than half of this area is actually under cultivation in field crops.

Any one who drives through the island along the country roads must be impressed with the appearance of prosperity and comfort everywhere. The farms are neat, clean and well cultivated, the houses comfortable and homelike; hedges are more common than in any other part of Canada and everything looks wonderfully fresh and green except when covered with the whiteness of winter snows. The soil of fields and roadways is red and contrasts strongly with the green of the grass, trees and hedges and even with the green of the growing grains and vegetables.

Prince Edward Island is distinctly a farmers' and fishermens' province. The island has no mineral resources. Coal is believed to exist at a very great depth, but the cost of getting at it would be so great as to make mining unprofitable in competition with the coal of Nova Scotia under present conditions. There are few manufacturing industries and those that do exist are closely related to farm production and the fisheries, such as the preparation of condensed milk, pork packing, starch manufacture from potatoes, and the canning of lobsters.

The fisheries are important. Lobsters and oysters are the greatest source of revenue but large catches of cod, hake, haddock, herring and mackerel are made. There are 210 lobster canneries in operation in this province.

The climate is healthy and agreeable. The atmosphere is clear, fogs being seldom experienced. In January and February, the coldest months, the thermometer sometimes registers as low as fifteen degrees below zero for a few hours at a time, but such cold is exceptional, the average of all temperatures during January and February for seven years being nearly seventeen degrees above zero.

The soil of Prince Edward Island is naturally very fertile, and the farmers believe that when exhausted by over-cropping a good dressing of the mussel mud formed by the decay of oyster, clam and mussel shells in all the bays and river mouths has a marvellous effect in restoring fertility. In winter dredging machines are placed on the ice in the bays and dig up the mud for use as a fertilizer. However, with a view to protection of the oyster beds the Provincial Government has made regulations providing that no digging shall be done within 200 yards of a live oyster bed and then only when a fishery inspector's permit is given.

Oats, potatoes and hay are the most important crops, but small quantities of wheat, barley, buckwheat, beans and peas are produced. Apples, plums and cherries, currants, gooseberries, raspberries and strawberries are successfully grown, but the majority of the farmers pay little attention to fruit growing.

FUR FARMING.

But the most interesting feature of Prince Edward Island farming at the present time is the breeding of fur-bearing animals and especially silver black foxes. Some years ago two farmers in the northern part of the island noting that the fur of the Prince Edward Island silver black fox commanded higher prices than any other fox fur on the London market entered into a partnership to breed foxes in captivity. The stock was bred from Prince Edward Island wild foxes caught in traps and held in captivity in wire enclosures. The experiment proved a great success; the pelts sold at prices ranging from $100 to $2,000 each, seldom selling for less than $500 a pelt, and the two pioneers amassed large fortunes before the nature of their enterprise became widely known. Their example was followed by others and it was soon found that more money could be made in selling pups for breeding purposes than in selling the pelts. The demand for silver fox pups became so great that the price steadily increased, and at the time the great war broke out five months' old silver fox pups of the best Prince Edward Island stock were selling at from $12,000 to $16,000 per pair and old stock of proved fecundity realized as much as $35,000 per pair. When the pups could be bought at from $1,000 to $4,000 per pair a number of farmers started fox ranches, but when the price went up above $10,000 it became impossible for the ordinary farmer to individually buy foxes. Then it occurred to some one to organize joint stock companies for fox breeding purposes. In April 1914 there were in Prince Edward Island 194 limited liability joint stock companies that had been organized for the purpose of breeding fur-bearing animals chiefly silver black foxes. These companies had an authorized capital of $31,232,700, but a number of the companies have not yet been floated and probably not more than half the stock has been actually issued. A large proportion of the farmers of Prince Edward Island are said to have invested in the stock of fur-farming companies. The farmers of the island had always been prosperous. They had large sums of money in the saving banks and the huge dividends paid by some of the companies induced general investment in stock of fur-farming companies. Besides the joint stock companies about three hundred individual farmers are registered as having ranches for breeding fur-bearing animals. Karakul sheep, from which the famous Persian lamb skins are obtained, have been imported into Prince Edward Island by some of the fur farmers and are now being successfully bred in the island. The breeding of red foxes, crosses between silvers and reds, blue foxes, minks, otters and skunks is being undertaken in some cases by farmers who cannot afford to pay the high prices demanded for silver fox breeding stock. Breeders of skunks cut out the scent glands when the animals are about two months old, thus removing all possibility of disagreeable odour.

Very few silver fox pelts have been sold in Prince Edward Island in recent years owing to the great demand for breeding stock, but it is generally agreed that as the silver foxes on the ranches are rapidly increas-

ing the industry will come down to a pelt basis in a few years. The calculation has been made that if the prices should keep up long enough to enable the farmers to get back the money they have invested in fox breeding they could afterward make good profits raising silver foxes for pelts if the price of pelts should fall as low as sixty dollars. Mr. J. Walter Jones who was selected by the Canadian Commission of Conservation to make a special study of Prince Edward Island fur farming, says: "Even if pelts fell to thirty dollars foxes could be raised profitably by a farmer who maintained other live stock. In many districts the annual cash outlay per fox for food need not exceed five dollars, and attending to twenty foxes would not involve so much labour as attending to ten cattle. If fox ranch fences cost more, the land and houses cost much less. The fox, moreover, reproduces rapidly and comes to maturity in eight months." However this estimate of the cost of feed is probably much below the present average cost of feeding foxes in Prince Edward Island. Some of the breeders estimate that it costs them fifty dollars a year to feed a pair of foxes. As regards prices of silver fox skins in 1914, Mr. Jones said: "At the present time the average price of wild silver fox skins in London is about two hundred dollars, and for ranch foxes such as are found with the best ranchers, twelve hundred dollars. Wild silver fox skins are not always prime and they are frequently shot, chewed, mangled and poorly dressed, while ranched foxes are usually killed when their fur is in prime condition. The highest price ever paid at the London sales for a silver fox skin was $2,900. It is said that this skin was sold by a Paris firm which had bought it at a previous sale for $1,950 and that it was from a ranched fox from Prince Edward Island. The next highest price was $2,700, and half a dozen have sold for $2,500 or more, all being from Prince Edward Island ranches. A remarkable sale was made in March, 1912, when a pelt from a fox that died in James Rayner's ranch at Kildare, Prince Edward Island, on October 12, 1911, brought the highest price, $2,050, although the skin would not have been fully prime before December."

Prince Edward Island fur breeders claim that the climate of the island is more favourable to foxes than any other known locality, and they point to the price realized by Prince Edward Island skins at the London auction sales as proof of their contention.

Prince Edward Island's example is being followed in other provinces of the Dominion. Up to April, 1914, Nova Scotia had issued fur farming permits to 205 individuals, 36 partnerships and 9 joint stock companies, while 46 joint stock fur farming companies had been incorporated in the province. At the same date 42 joint stock fur farming companies had been incorporated in New Brunswick, and 27 individual farmers had received permits to engage in fur farming. In Quebec province fur farming permits had been issued to 21 firms and companies. Ontario had no incorporated fur farming companies at that time, but there were 30 fur farmers registered in that province. In Alberta nine fur farming companies had been incorporated; in British Columbia, two; in Manitoba, one.

THE TOWNS OF PRINCE EDWARD ISLAND.

Charlottetown, the capital of Prince Edward Island, is a handsome little city, with a number of very wide streets. There is a public square

in the centre where all the public buildings are concentrated. It has a fine harbour but it is sometimes blocked by ice in winter. The population is about 12,000. The next largest town is Summerside, with a population of about 3,000, while Souris has a little over 1,000 and Georgetown somewhat less.

One of the assets of Prince Edward Island is its attractiveness for summer tourists. The bathing beaches are especially fine.

THE POPULATION OF THE ISLAND.

The population of Prince Edward Island at the census of 1911 was 93,728, that is 42·91 per square mile, while the population of the whole Dominion was only 1·93 per square mile. But while Prince Edward Island seems quite densely populated compared with the whole Dominion of Canada, the population is not dense compared with that of many other countries. The state of Rhode Island, with an area of 1,248 square miles compared with Prince Edward Island's area of 2,184 square miles, had a population of 542,694 at the last census. Rhode Island is a manufacturing state, but we may compare Prince Edward Island with the islands of Jersey and Guernsey in the English Channel, which are purely farming and fishing communities. Jersey and Guernsey have together a little over 93,000 people, almost exactly the same population as Prince Edward Island; yet their combined area is only 69½ square miles. Prince Edward Island, with over thirty-one times the area of Jersey and Guernsey and nearly the whole of its area very fertile, with a climate most favourable to human life and to all kinds of live stock, with fish in abundance in the surrounding sea and all the bays and river mouths, might have a population of over three millions and yet be less densely populated than the Channel Islands. It is not probable that Prince Edward Island will ever be so densely populated as the Channel Islands, but this comparison will make it evident that there are still possibilities of great expansion in Canada's smallest and most densely populated province.

TRANSPORTATION BY RAIL AND WATER.

A Canadian Government railway run as part of the Intercolonial system provides transportation from end to end of the Island. In summer steamers ply daily between Charlottetown and Pictou, N.S., and between Summerside and Pointe du Chene in New Brunswick. Winter communication has hitherto been maintained by ice-breaking government steamers running between Georgetown and Pictou. The Intercolonial railway is now preparing to run a car ferry from Cape Tormentine, N.B., to Carleton Point, Prince Edward Island, the distance between these points being only eight miles. Terminals are now being constructed at Tormentine and Carleton Point, and it is expected that the ferry will be in operation in the season of 1916. The ferrry has been specially designed to meet winter ice conditions. It will run continuously throughout the year and it is believed that it will be nearly as effective as a tunnel would be in maintaining constant communication between the island and the mainland. A branch of the Intercolonial railway known as the New Brunswick and Prince Edward Island railway runs from Sackville, N.B., to Cape Tormentine and will connect with the car ferry.

Chapter IV.

THE PROVINCE OF NOVA SCOTIA.

The province of Nova Scotia is 386 miles in length by from fifty to one hundred miles in width with an area of 21,068 square miles and extends from the forty-third to the forty-seventh parallel of latitude. It consists of the peninsula of Nova Scotia, connected with New Brunswick by the isthmus of Chignecto, and the island of Cape Breton, which is separated from the mainland of the province by the narrow strait of Canso. Cape Breton Island has an extreme length from north to south of 110 miles, its greatest breadth being 87 miles, and its area is 3,120 square miles. Cape Breton is not only surrounded by the sea, but has the sea inside of it, for the beautiful salt water lakes of Bras d'Or may be regarded as merely arms of the sea with which they are connected at the northeast by two natural channels, while at the south St. Peter's ship canal connects them with St. Peter's bay.

Nova Scotia is almost as large as Belgium and Holland combined which together have over twelve million people. Belgium with an area of 11,373 square miles has a population of over seven millions and Holland with an area of 14,613 square miles including the Zuider Zee has over five million people. As regards climate, natural resources and accessibility Nova Scotia compares very favourably with Holland and Belgium. The State of Massachusetts has an area of only 8,266 square miles as compared with Nova Scotia's 21,068 square miles. Massachusetts has no coal and the only important minerals are granite and limestone; the local fisheries are not especially valuable; the area of fertile soil is not extensive, some sections being rocky while sandy wastes are common; yet Massachusetts owing to the development of manufactures has a population of nearly three and a half million people compared with Nova Scotia's population of 492,338 in 1911.

The most northern part of Nova Scotia is several degrees farther south than the most southern point of the British Isles. The most southern point is farther south than Marseilles, France. Halifax, the capital of the province, is in latitude 44° 26′ 11″ N., almost the same latitude as Genoa, Italy, which is 44° 24′ 16″ N.

Owing to its almost insular position and perhaps to the influence of the Gulf Stream, which flows not far from its southern extremity, the climate is more moderate than that of the neighbouring state of Maine. Extreme cold is seldom experienced in any part of the province, but the northern counties are more exposed to the influence of the Arctic current flowing through Belle Isle than those of the south and along the Bay of Fundy. Thus Annapolis township is seven or eight degrees warmer on the average than the counties in Cape Breton and along Northumberland Strait, five or six degrees warmer than Halifax and Colchester counties and three or four degrees warmer than the famed country of Evangeline along the Basin of

A Nova Scotia Farm.

The Public Gardens, Halifax.

Minas. Yarmouth, the most southern county, has very mild winters. According to the meteorological records at Yarmouth town for a period of seven years the minimum temperatures averaged in January and February 1·3°; March 5·6°; April 21·6°; May 30°; June 38·1°; July and August 42°; September 37·7°; October 28·2°; November 18·4°; December 5·2°. The average of all temperatures for seven years was in January and February 25·4°; March 29·5°; April 38·5°; May 47·1°; June 55·1°; July and August 59·8°; September 55·2°; October 47·6°; November 40·2°; December 30·9°. The average maximum temperatures for seven years were: In April 59·4°; May 67·9°; June 75·3°; July and August 77·1°; September 72·3°; October 67°; November 58·6°. The atmosphere of Yarmouth is moist and the summer temperatures are much lower than those of the Annapolis Valley. In Sydney, Cape Breton, at the north end of the province, the thermometer sometimes touches thirteen below zero, the average for January and February for seven years being 18·9 degrees above zero, while at Halifax about half way between Yarmouth and Sydney, the greatest degree of cold experienced in an average winter is between six and seven degrees below zero, the average of all temperatures at that point during January and February for seven years being 22 degrees above zero.

The winters of Nova Scotia are short, but in the northern counties the spring is long and backward owing to the chilling influence of the ice that drifts through Belle Isle. This is especially true of the island of Cape Breton, which is besieged with drift ice every spring.

A GREAT APPLE COUNTRY.

The garden of Nova Scotia is in the Annapolis and Cornwallis valley, a district about eighty miles long and from four to twelve miles wide, protected from the summer fogs of Fundy and the chilling ocean winds by two ranges of hills known as the North and South Mountains. The North Mountains skirt the south shore of the Bay of Fundy from Briar Island to the Basin of Minas terminating in a bold bluff called Cape Blomidon. On the other side of Minas channel the range is continued under the name of the Cobequid Mountains, acting as a shield against the cold winds coming from the Gulf of St. Lawrence in the spring. The Annapolis Valley is famous for its apples which command the highest prices in the London market. While the climate and soil seem particularly adapted to the production of apples they are also favourable to grapes, pears, plums, cherries, melons and tomatoes and even peaches are successfully grown. King's county, the scene of Longfellow's " Evangeline," is also a great apple producing district. Although not quite so warm as Annapolis township it is equally fertile and the dyked lands are as productive now after centuries of tillage as when they were cultivated by the simple Acadians.

In a good year Nova Scotia produces about 1,750,000 barrels of apples and the annual production is likely to greatly increase. At present most of the apples are grown in Annapolis and King's counties, but the government of the province is showing by means of model orchards in other counties that apples can be successfully grown in any part of the province where the soil is suitable. Even in Annapolis county there is a large area of land suitable for growing apples not yet occupied by orchards. The Secretary

for Agriculture of the Province of Nova Scotia said in his last report: "The most important movement among the fruit growers of Nova Scotia during the past few years has been the organization of co-operative fruit companies of which there are now thirty-two distributed all along the line from Windsor to the western border of Annapolis county. Nearly all these local companies have been combined into a central company known as 'The United Fruit Companies.' The United Company will handle approximately half the apple crop of Nova Scotia during the present year." It may be noted that the United Fruit Companies handle the potatoes as well as the apples grown by the members.

All the counties bordering on the Basin of Minas, and those lying along Cumberland strait and the gulf are good agricultural districts. Excepting Yarmouth none of the counties along the Atlantic coast are generally well adapted for agriculture, although they contain small tracts of excellent farming lands and no doubt some of the land now considered unsuited for cultivation could be made productive under a system of scientific farming. Very little wheat is now raised in Nova Scotia. The chief field crops are oats, hay, buckwheat, potatoes and other vegetables. Nova Scotia does not equal Prince Edward Island in the production of cheese, but surpasses it in the production of butter and condensed milk. The fine quality of the wool produced in Nova Scotia has already been referred to and the natural conditions of the province are very favourable not only for sheep but all kinds of live stock.

NOVA SCOTIA FORESTS.

It is estimated that fully two-thirds of the area of Nova Scotia is either covered with forest growth or consists of burned over forest lands more suitable for reforestation than for any other use. The trees of Nova Scotia include spruce, hemlock, white pine, birch, balsam, fir, maple, beech, red pine, oak, aspen poplar, balsam poplar, cottonwood poplar, jack pine, cedar, ash and tamarack. The three woods most largely cut are spruce, hemlock and white pine.

During the years 1909 and 1910 Prof. Fernow, the forestry expert of Toronto University, and a staff of assistants made a forest reconnaissance of Nova Scotia at the request of the Provincial Government. Reviewing the conditions in Cape Breton Island and the mainland separately, Prof. Fernow estimated that the mainland of Nova Scotia contains approximately nine billion feet of coniferous timber at present suitable for sawing, and that including Cape Breton the whole province contains nearly ten billion feet of such timber. He estimated that in addition to this saw-timber, coniferous trees on the mainland suitable for pulpwood would yield about ten million cords of pulpwood and those in Cape Breton Island about fourteen million cords, a total of about 24,000,000 cords of pulpwood in the province. He made no estimate of the quantity of hardwood suitable for sawing, but the area of the hardwood is given as 330,901 acres on the mainland and about 195,968 acres in Cape Breton Island. However there are large areas of land covered with young trees that will be large enough for sawing before many years.

THE FISHERIES OF NOVA SCOTIA.

Along Nova Scotia's much indented sea coast are the breeding and feeding grounds of countless millions of fish. There are many prosperous fishing villages and the fishermen form one of the most influential elements of the community. Full details are given in Chapter XIII, devoted to the fisheries of Canada.

THE COAL OF NOVA SCOTIA.

Nova Scotia has the only coal yet discovered on the Atlantic seaboard of America. The coal is bituminous, of good quality, some of the seams being particularly suited for steam-making and for the manufacture of coke for blast furnace use, while others are better adapted to the production of gas. There are extensive beds of coal with seams of great thickness on both the eastern and western coasts of Cape Breton Island, in the central county of Pictou and in Cumberland county at the extreme west of the province. Mining operations are carried on in each of these sections, so that there are mines convenient not only to all parts of the province of Nova Scotia but also to Prince Edward Island and New Brunswick, while in summer shipments can be made from all the mines by way of the St. Lawrence river to the province of Quebec. During the year 1913 the production of coal in Nova Scotia by counties was 5,594,192 tons in Cape Breton county, 703,583 tons in Pictou county, 621,864 tons in Cumberland county, and 284,274 tons in Inverness county, a total of 7,203,913 tons, of which 3,341,768 tons were consumed in the Maritime Provinces of Canada, 210,544 tons in Newfoundland, 2,193,228 tons in Quebec province, 21,391 tons by time chartered boats, 234,177 tons for bunkering, 468,090 tons in the United States, and the remainder in other countries.

MANUFACTURING INDUSTRIES.

The sales of Nova Scotia coal for consumption in the province of Nova Scotia have increased 86 per cent within ten years. This great increase in local consumption is due to the recent development of manufacturing industries. Not many years ago the province had very few manufactures. Now there are about 1,500 manufacturing establishments with nearly 30,000 employees.

Among the articles manufactured are boots and shoes, cotton piece goods, sheetings, shirtings and bag cloths, cotton sail ducks, ounce duck, belting and horse duck and papermakers' felt, knitted underwear, pure wool textiles, including fine tweeds, dress goods, blankets, hats and caps, saddlery and harness, trunks, pulp and paper, sashes, doors, and all kinds of interior and exterior woodwork and builders' supplies, church, school, bank, office and household furniture, pianos, coffins, refined sugar, biscuits, chocolate and confectionery, condensed milk, pig-iron, steel ingots, blooms and billets, steel rails, steel rods, steel plates, shapes and bars, bar iron, wire nails, bolts, nuts, rivets, railway spikes, screws, rifle sights, taps, dies, tools and oil tempered springs, stoves, ranges, furnaces, steel bridges and general structural steel, engines and boilers for industrial works, marine engines and boilers, marine gasoline engines, ships' tanks and

funnels, smokestacks, ships' windlasses, capstans, patent steering gears and other steel and brass equipments for passenger and freight steamers, coal mining machinery, cast-iron water pipe and miscellaneous iron castings, steel skates, carriage axles, rotary saw-mills, gang edgers, shingle mills and other machinery for lumbering operations, railway cars, automobiles, auto trucks, carriages and sleighs, springs and mattresses, bath tubs, laundry tubs, lavatories, sinks, sulphate of ammonia and other fertilizers, and a variety of tar chemical products. Large quantities of shells and other ammunition have been made since the outbreak of the German war.

CAPE BRETON AN IRON AND STEEL CENTRE.

The greatest of the industries is the manufacture of iron and steel. British success in supplying foreign markets with iron and steel has been largely due to the fact that the United Kingdom had extensive supplies of coal and iron ore close to the seaboard and could get supplies of iron ore conveniently from other countries, while the geographical position of the country is favourable to a world-wide commerce. Nowhere else can conditions be found more nearly similar than in the Canadian island of Cape Breton. Coal is very widely distributed in Cape Breton, but the most valuable seams are those included in the coal field of Sydney, extending from Mira bay on the east to Cape Dauphin on the west, a distance of 31 miles, and occupying a land area of over 200 square miles, besides extensive submarine areas. The greater part of these coal areas are controlled by the Dominion Steel and Coal Company and the Nova Scotia Steel and Coal Company, the former now operating seventeen collieries and the latter five collieries. The areas of the Dominion Company lie chiefly to the south of Sydney Harbour, while those of the Nova Scotia Company extend from the north side of Sydney Harbour to the south side of the Great Bras d'Or lake. Both companies have extensive submarine areas. The shipping port of the Nova Scotia Company is North Sydney, on the north side of Sydney Harbour, while the Dominion Company has two ports, Sydney, on the south side of Sydney Harbour, and Louisburg, which is 22 miles from Sydney in a bee line and 40 miles by the Sydney and Louisburg railway, belonging to the Dominion Steel and Coal Company.

In considering the future prospects of iron and steel manufacture in Cape Breton the first factors to be taken into account are the character and extent of the raw materials, iron ore, limestone and fuel, their distance from each other and the means of transportation. For purposes of comparison it may be well to outline the conditions that exist in the United States and the United Kingdom. The first furnaces in the Pittsburg district were started on local ores, but now almost the entire supply comes from the mines in the vicinity of Lake Superior. James M. Swank, for many years manager of the American Iron and Steel Association in his book "Iron and Steel in All Ages," described the conditions in the great iron-making centres of the United States as follows: "From the iron ore mines of Michigan and Minnesota to the coal of Pennsylvania the distance is 1,000 miles. Connellsville coke is taken 600 miles to the blast furnaces of Chicago and 750 miles to the blast furnaces of St. Louis. The average distance over

which all the domestic iron consumed in the blast furnaces of the United States is transported is not less than 400 miles, and the average distance over which the fuel that is used to smelt it is transported not less than 200 miles." The iron used in the Pittsburg district has to be brought from the mines of Northern Michigan and Minnesota by rail to a Lake Superior port and there loaded on vessels, after which it must be carried through Lake Superior, the Sault canal, lake Huron, lake St. Clair, the tortuous channel of the Detroit river and finally through lake Erie to Cleveland and other lake ports, where it is transferred to railways again to be transported to the furnaces. This makes four handlings of the ore in transportation from the mines to the furnaces. When the iron and steel is made at Pittsburg it has to go by rail to Philadelphia, 354 miles; to New York, 445 miles; to Boston, 675 miles; to Buffalo, 270 miles.

The only blast furnaces of the United States that have their raw materials close together are in the Southern States. Of these the most favourably located are those of the Birmingham district in Alabama, where fuel and ore are very close together. However, the Alabama furnaces are far from the leading markets both of the United States and other countries, and the freight rates on the pig iron and steel must be added to the cost of production. The nearest seaport is Mobile, 276 miles by rail from Birmingham, the centre of the iron district. It is 349 miles by rail from Birmingham to New Orleans, 448 miles to Savannah, 476 miles to Charleston, 766 miles to Newport News, 804 miles to Baltimore, 855 miles to Philadelphia and 794 miles to Pittsburg.

The British blast furnaces at one time used only local ores, but now very large quantities of ore are imported. For many years British iron makers have been drawing ore supplies from Spain. In recent years ore has been imported quite extensively from the Gellivara district of Sweden, which is considerably north of the Arctic circle. The ore is carried by rail across Sweden and Norway to the Norwegian harbour of Ofsten, 130 miles north of the Arctic circle, where it is shipped to the British blast furnaces. The London *Economist* some years ago discussing the future of iron and steel manufacture in Great Britain said: "It must be remarked for how long a period the mines in this country have been worked. The output of black band ore in Scotland has been decreasing for years past and the greater portion of the pig iron now made in that district is from foreign ores. Cleveland, which has been one of the most prolific districts in the country, has now been worked nearly fifty years, and the best ore having been taken out we may soon have to fall back on the poorer and consequently costlier kinds. It has been known for some time past that the best hematite ores in the Bilboa district in Northern Spain are fast deterioriating and if we have to fall back on the poorer qualities, those containing a lower percentage of iron, they will be more costly, owing to the proportionately greater cost of carriage by sea."

The supplies of coal and limestone for the Cape Breton blast furnaces are close at hand, but the iron ore is brought from Great Bell Island in Conception Bay off the coast of Newfoundland about 400 miles from Sydney harbour. English mining engineers have estimated that there is enough ore in the areas already opened up by the Dominion Steel Company

to supply a plant larger than that now in existence at Sydney for over a hundred years and there are outer areas belonging to the company which if the seams are continuous as is supposed would in their opinion probably yield a much larger quantity of ore than the areas now being worked. The ore has a good percentage of iron. It is low in sulphur but rather high in phosphorus. It can be mined very cheaply and as the mines are close to deep water docks, while the blast furnaces are on the water front of Sydney harbour with deep water docks at hand it is claimed that the iron ore can be delivered at the furnace at lower cost than at any other blast furnaces in America except in the State of Alabama where iron ore and coal lie near together. The iron ore deposits of the Nova Scotia company adjoin those of the Dominion company and are of the same quality. H. Kilburn Scott, an eminent English engineer, has estimated that the iron areas of this company contain 206,000,000 tons of iron ore practically proved and of iron ore reasonably supposed to exist more than twice as much. Nearly all this ore is under the sea but the company reports that it has been driving tunnels and slopes in it without any inconvenience on that account. The ore can be laid down at the dock of the Nova Scotia company at North Sydney as cheaply as at the dock of the Dominion company on the other side of the harbour, but there is a rail haul of two miles on the company's own railway to the blast furnaces at the coal mines.

While the Dominion company has all its iron and steel works concentrated at the Sydney water front, the Nova Scotia company manufactures only pig iron and steel billets in Cape Breton, its steel works for more highly finished products being at New Glasgow in Pictou county. In 1913 there were produced in Nova Scotia by these companies 486,962 tons of steel ingots.

BY-PRODUCTS FROM COKE OVENS.

In converting coal into coke for use in the blast furnaces at Sydney by-product ovens are used, and in addition to obtaining large quantities of gas for use at the works tar and ammonium sulphate are recovered. There is a good market for the sulphate of ammonia on the sugar plantations of the West Indies. From the tar by distillation pitch, light volatile oils, creosote, carbolic acid and benzol are obtained.

THE HARBOURS OF SYDNEY AND LOUISBURG.

It is an extraordinary fact that the harbours of Sydney and Louisburg, while more than 2,200 miles nearer to Liverpool than Mobile and New Orleans, the nearest ports to the southern blast furnaces, are at the same time about 600 miles nearer to Pernambuco, Rio Janeiro and Buenos Ayres, and about 900 miles nearer to Cape Town, South Africa. Ham-shaped South America lies far to the east of North America, while New Orleans, Mobile and other ports on the gulf of Mexico are a long distance west of the Atlantic ocean. Moreover, ships from southern ports of the United States cannot take a direct route because they have to steer clear of the West India islands. Cape Breton, jutting far eastward into the Atlantic, is much nearer to a direct line drawn north from the east coast of South America.

And the gulf of Mexico ports are not the only ones over which Cape Breton ports have an advantage. The whole Atlantic coast of the United States slopes away toward the southwest, and Savannah, Charleston, Baltimore, Philadelphia and New York are so far to the west of the direct routes from Sydney and Louisburg that the Cape Breton ports although farther north, are nearer to the chief towns of South America and Africa as well as to every part of Europe.

The most eastern point of South America is Pernambuco. All vessels going south of that point to Rio Janeiro, Buenos Aires, or other ports on the east side of South America must pass it. The following tables of distances in nautical miles will show the great advantage that Sydney has over all American ports for trading with Great Britain and other countries of Europe, South America and Africa.

From	Miles to Liverpool.	Miles to Cape Town.	Miles to Pernambuco.
Sydney Harbour :—			
Via Cape Race and North of Ireland	2,284	6,573	3,565
Via Cape Race and South of Ireland	2,309	....	... .
New Orleans	4,528	7,347	*4,109
Mobile	4,466	7,291	*4,047
Savannah	3,596	6,860	3,681
Charleston	3,502	6,828	3,649
Newport News	3,201	6,786	3,649
Baltimore	3,328	6,912	3,772
Philadelphia	3,216	6,861	3,745
New York	3,071	6,786	3,698

* *Via* Key West

The distances given are for routes for full-powered steamships.

In considering Sydney's advantages as a steel and coal centre in comparison with other localities in America, it must be remembered that the coal mines and steel works of the United States are not near the sea coast, and to reach any of the ports in the above table of distances their products must be carried hundreds of miles by rail.

AN EASY HARBOUR TO ENTER.

Sydney harbour is a magnificent one, in which all the fleets of the great powers might ride in safety without crowding one another. It is not only long and wide, but very deep. In the South Arm, which constitutes the port of Sydney, the general depth is from 42 to 54 feet, except close to the shore, and at the end of the piers of the Dominion Iron and Steel Company it is 42 feet deep. It is claimed that this harbour is more easy of entrance than any other in America, the mouth being wide and absolutely free from rocks and shoals. There are two bars, one on each side of the harbour at some distance from the mouth, which give absolute protection from ocean storms to the ports of Sydney and North Sydney, but the water between them is wide and deep, and the soundings from the deep sea converge toward the inner harbour in such a way that mariners entering these ports can have absolute assurance that they are free from all dangers. Vessels passing out of the harbour enter at once

into open sea and can go at full speed. From the mouth of the Sydney river to the outer entrance of Sydney harbour is a distance of about seven miles. Owing to the fact that the central portion of the old town of Sydney is situated on the Sydney river, where it flows into the harbour of Sydney, and because this river freezes in winter the impression generally prevails that Sydney harbour is frozen over every winter. The piers of the Dominion Iron and Steel Company and the Dominion Coal Company on Sydney harbour are about a mile farther out than the mouth of the river, and in any ordinary winter steamships would seldom have any difficulty in running to them. Drift ice occasionally blocks the approaches to the harbour in severe winters. Probably ten months is the period of certain navigation.

The harbour of Louisburg, which possesses all the advantages of Sydney as regards short distances from the markets of the world, is open throughout the year. On rare occasions the approach to it is made difficult by drift ice in the Atlantic ocean, but the floating ice, whether from the gulf of St. Lawrence or the Atlantic, is usually deflected by its impact with Scatarie island, which impels it in a southerly direction. The waters of the harbour are never frozen. It is claimed that there is seldom or never troublesome ice in the Atlantic in the vicinity of Louisburg at the same time that the approaches to Sydney harbour are blocked with ice, as the wind must blow from a different direction to bring the ice near Louisburg, so that one harbour or the other can always be reached, and with Marconi signal stations in operation vessels should never suffer much delay as the two harbours are not far apart. Louisburg harbour, while not so capacious as Sydney harbour, is sufficiently roomy for all commercial purposes. The depth of water at the pier of the Dominion Coal Company is 32 feet and the general depth of the ship channel is from 36 to 66 feet. Situated on the southeast side of Cape Breton and a little to the westward of Scatarie island, it is the nearest harbour on the American continent to England and the continent of Europe that can be reached by rail. It is safe, easy of access, close to the sea, well sheltered with good holding ground, and offers peculiar advantages as a coaling station for vessels trading between Europe and South America. The advantages of Louisburg as a port of call and its facilities for the cheap and prompt supply of coal and necessaries are almost identical with those of Sydney, while its importance as a shipping port for coal destined for the United States of America has been demonstrated by the Dominion Coal Company, which has made regular shipments from Louisburg to Boston for a number of years in all seasons.

Considering Sydney and Louisburg as bunkering stations it may be said that for vessels trading between Europe and the gulf and river St. Lawrence, Sydney and North Sydney are the more convenient ports for coaling, but for vessels trading between ports of the United States and Europe or between South America and Europe, Louisburg is more convenient. It is particularly worthy of note that it lies half way between Europe and the shipping ports of the Southern States, so that a steamer with cotton, etc., from New Orleans or other southern ports can carry a much larger cargo by taking half the necessary coal at the port of departure and replacing it by the other half obtained at Louisburg.

NOVA SCOTIA IRON ORES.

If all the iron ore deposits in Nova Scotia were concentrated at one point there would be enough to supply very extensive works. There are indications of iron in almost every part of Nova Scotia and at one time it was commonly supposed that the province had almost inexhaustible supplies of this mineral. Investigation showed that most of the deposits were merely pockets and the impression became general that extensive bodies of ore would never be found in Nova Scotia. However, development work carried on at Torbrook in Annapolis county indicates that the deposits there are very extensive. The ore is red hematite containing a good percentage of iron rather high in phosphorous but not very high in sulphur. The plant of this mine has a daily capacity of 1,000 tons and shipping facilities have been provided at Port Wade, N.S., with a dock-loading capacity of 2,000 tons per hour. The Londonderry iron range in Colchester county extends for many miles and although the deposits are not very deep, the total quantity of ore is believed to be quite large. There are a number of varieties of ore in this range, including hematite, limonite, ankerite, siderite and specular ores. There is some reason to believe that there is an extensive ore bed at Arisaig on the coast of Antigonish county, but as no development work has been done this is uncertain.

If the iron ore deposits at Arisaig should prove to be extensive, of good quality and susceptible of being cheaply mined, the ore might be conveniently carried either to the coal of Pictou county or to the coal on the west coast of Cape Breton. It is possible that blast furnaces may yet be located in the vicinity of Pictou harbour, using Pictou coal and drawing ore supplies from Pictou county, Arisaig and perhaps New Brunswick and Newfoundland.

Except in the case of some small pockets the iron ores of Nova Scotia are too high in phosphorous to make Bessemer pig iron. They are usually low in sulphur, but Nova Scotia coal is commonly somewhat high in sulphur.

Mr. J. E. Woodman, a mining engineer who has prepared a very interesting report on the iron ores of Nova Scotia for the Dominion Department of Mines, expresses the opinion that there are scattered throughout Nova Scotia in close proximity to transportation facilities by rail or water a large number of deposits which, while not individually extensive enough to justify the erection of local smelters could be economically mined for transportation to smelting centres. He says: "It is even an open question whether it would pay existing smelting companies to buy them up. But if instead the individual owners were to develop them and contract for sale of the ore to the smelters even under the present conditions a number of the isolated deposits could be profitably opened."

Mr. J. E. Woodman suggests that Parrsboro, a port on the Basin of Minas would be a favourable location for an iron and steel plant of large size. He says that ores could be conveniently brought to Parrsboro from the whole western Cobequid range, from the Torbrook and Clementsport mines in Annapolis county and from the ranges in Colchester and Hants counties; for flux limestone could be obtained in the vicinity of Windsor and anchorite from the Londonderry range, while coal from Springhill

would have a rail haul of 27 miles on a down grade. The distance by rail from the Torbrook iron mines to Port Wade. the shipping port is 42½ miles while Port Wade is 77 miles by water from Parrsboro. Iron and steel produced at Parrsboro could be conveniently distributed to all parts of Nova Scotia and New Brunswick. The distance by water from Parrsboro to St. John, N.B., is 82 miles.

GOLD IN NOVA SCOTIA.

The gold bearing rocks of Nova Scotia extend along the Atlantic coast from Canso to Yarmouth and are estimated to cover about 3,000 square miles. Very little capital has been invested in them. but mining operations on a small scale have been steadily continued for a little over half a century and over seventeen and a half million dollars worth of gold have been extracted, the annual average being over 18,000 ounces of gold.

OTHER MINERALS IN NOVA SCOTIA.

Gypsum of high grade occurs in large quantities in Nova Scotia being found in Hants county, Cumberland county, Victoria county, Inverness county and Cape Breton county. At present the annual output is valued at about half a million dollars.

Ores of manganese have been found in Cape Breton county, Hants county and Colchester county.

Deposits of barytes are found in Colchester county, Pictou county and Inverness county, but the only deposits being mined are those in the vicinity of Lake Ainslie in Inverness county.

Tungsten is mined in small quantities in the Moose River district of Nova Scotia. It has also been found in Halifax county, Inverness county, and Lunenburg county, but how extensive the deposits are is not known.

There are indications of graphite in Guysborough, Colchester and King's counties, but no deposits of commercial importance have yet been recorded.

Copper sulphides have been discovered at a number of points, but no important producing mines have been developed.

There are some argentiferous galena deposits in Cape Breton county near East Bay and Musquodoboit. but they have only been worked intermittently and their value is uncertain.

Antimony concentrates are obtained in small quantities at West Gore in Hants county.

Tin ore has been found near New Ross, Lunenburg county, and geological experts have reported rather favourably, but no development work has been done and it is not known whether there are sufficient quantities to be of commerical value.

Millstone grit is quarried in Pictou county and manufactured into grindstones of excellent grades, ranging in size from very small stones to those used for the grinding of wood pulp which weigh about 2½ tons each.

Tripolite or infusorial earth is found in Victoria, Inverness and Cumberland counties, but the only place where it is being taken out is at Bass River lake in Cumberland county.

Portland cement is manufactured from blast furnace slag at Sydney, N.S.

Fireclay suitable for the manufacture of firebrick has been found at Shubenacadie, in Hants county.

Granite is quarried near Halifax, and at Nictau in Annapolis county.

Very fine sandstones for building purposes are quarried in Cumberland and Pictou counties.

Salt springs have been found in Antigonish, Inverness, Cumberland and Hants counties, but no attempt seems to have been made to utilize them.

THE CITY OF HALIFAX.

The city of Halifax is the capital of Nova Scotia, the seat of the provincial university, Dalhousie College, with affiliated educational institutions, and the chief military and naval station of Canada. Its citadel rising high above the city is almost as famous as that of Quebec, but it is only one of a number of strong fortifications that command the city and harbour. However, Halifax owes its importance chiefly to its magnificent harbour and commanding geographical situation, which make it the natural landing place for passengers bound from Europe to all parts of the North American continent. The city is built on a peninsula between the harbour of Halifax and a beautiful inlet of the sea known as the Northwest Arm. Halifax harbour is six miles long, from one mile to a mile and a quarter wide and very deep. It is connected by a passage a quarter of a mile wide, known as the Narrows, with Bedford Basin, a deep land-locked bay, six miles long by four miles wide. The entrance to the harbour is wide, deep and free from currents. The tide rises only from four to six feet. At the front of the harbour is MacNab's island, which protects it from the ocean, making it a perfect haven for ships. Halifax is 616 geographical miles nearer to Liverpool than New York is, while the distance from Halifax to New York is 599 miles. It is claimed that if the fast ocean vessels which run from Liverpool to New York made Halifax a port of call before going to New York instead of going direct to New York, the only time lost would be that occupied in going in and out of the harbour and discharging cargo, while passengers and mails could be carried by rail to all the important commercial centres of America, including New York itself, before the ship would reach New York.

In the spring of 1913 the Hamburg-American line steamship *President Lincoln*, of 18,000 tons, arrived at Halifax at noon and sailed at 3 p.m., arriving in New York at 10 a.m. on the second day. Some of the passengers bound for Chicago landed at Halifax, while others went on to New York. Those who landed at Halifax took the train for the west at 7 p.m., and reached Chicago about the same time that the passengers who remained on the ship reached New York. At present the terminal facilities at Halifax are poor, but the Canadian Government recently began the construction of new terminals, which will make it one of the best equipped ports in the world. The total area used for the new terminals will be 260½ acres, and they are so located near the entrance to the harbour that they do not encroach upon the present harbour facilities. In addition to

Halifax City lies between Halifax Harbour and the North West Arm.

these terminals there are to be extensive freight yards at Bedford Basin. The engineer in charge of the work states that the landing quay will provide the safest and most rapid exchange between the steamship and the railway of any harbour in the world. There will be 27 steamship berths with a depth of 45 feet of water at lowest water. Owing to the great width and depth of the harbour opposite the piers there will be unusual facilities for the manœuvring of the largest ships and their access to the pier berths. In front of the piers and basins is an area of about one mile square with a depth of at least 70 feet at lowest water, forming an ideal natural turning, manœuvring and anchorage basin free from currents. The 45 feet of water at the piers is believed to be deep enough to accommodate the largest ships that are likely to be constructed, but even if ships requiring the enormous depth of 60 feet of water should ever be constructed, this depth could easily be obtained at the landing quay at a comparatively low cost by a simple extension outward. The Halifax graving dock, adjoining the Naval dockyard, is 650 feet long. It is proposed to extend it and make it the largest on the Atlantic seaboard of America.

The population of Halifax was 46,619 according to the census of 1911, but has grown steadily since the census. The town of Dartmouth, on the opposite side of Halifax harbour, which is connected with the city by a ferry running every fifteen minutes, must be regarded as forming part of Halifax from an industrial and commercial point of view, although not included in the city limits. Its population was 5,058 in 1911. The advantages of Halifax as a location for manufacturing industries have already been referred to. There are a number of industries in Halifax and Dartmouth, including a very large sugar refinery, extensive cordage works, cotton mills, railway car shops and factories turning out saw-mill machinery, bar iron, carriage axles, iron and steel forgings, nuts, bolts, railway spikes, boilers, tanks and funnels, marine buoys and smokestacks, boots and shoes, saddlery and harness, biscuits, chocolates, roofing and building papers, fertilizers, paints and varnishes, skates, etc. The skates manufactured at Dartmouth are sold in every country where there is skating on either natural or artificial ice.

OTHER TOWNS OF NOVA SCOTIA.

Sydney, the Cape Breton steel centre, had a population of 17,000 in 1911, while North Sydney had 5,118, Sydney Mines 7,470, and Glace Bay, the residential centre of the Dominion collieries, 16,562. Amherst, at the head of the bay of Fundy, is noted for its great railway car shops, its engine works, boiler shops, woodworking and steel structural materials. Boots, shoes, trunks, bags and suit cases, woollens, pianos, stoves, ranges, furnaces, bathtubs, lavatories, laundry tubs, sinks, etc., are also manufactured. Truro, an important railway junction in Colchester county, with a population of 6,107 in 1911, manufactures woollen underwear, boots and shoes, hats and caps and condensed milk. New Glasgow, on the East river in Pictou county, is the headquarters of the Nova Scotia Steel Company, which has its blast furnace and open-hearth steel furnaces at Sydney Mines, but carries its steel billets to New Glasgow to be converted

A bit of Halifax city.

Halifax harbour from the citadel.

into a variety of finished steel products. Other companies manufacture structural steel for bridges and buildings, boilers, coal mining machinery, farm and garden tools, oil tempered springs, rifle sights, spring mattresses and fencing. Large railway car shops have recently been established. New Glasgow's population was 6,383 in 1911, while the neighbouring town of Pictou, noted for its fine harbour and its biscuits, had 3,235. Yarmouth, at the extreme south of the province, has large cotton mills, producing sail duck, ounce duck, belting and hose duck. A line of passenger steamers runs from Boston to Yarmouth, where it connects with the railway system of the Maritime Provinces. Its population was 6,600 in 1911. It must be noted that in all these small cities and towns the manufacturing industries have developed greatly since 1911, when the census was taken, and some of the larger industries have been started since then. There has been a corresponding increase in population.

Apple blossoms in the Annapolis valley of Nova Scotia.

Chapter V.

THE PROVINCE OF NEW BRUNSWICK.

The province of New Brunswick with an area of 27,911 square miles may be compared with Scotland, which has an area of 30,000 square miles. It is not a mountainous country but is full of low hills and valleys. New Brunswick does not come so near to being an island as Nova Scotia, but with the bay of Chaleur at the north, the gulf of St. Lawrence and Northumberland Strait at the east, the bay of Fundy at the south and Passamaquoddy bay at the southwest it has a very extensive seacoast. Although larger than Nova Scotia the province of New Brunswick does not cover so many degrees of latitude. Its most southern point is a little south of 45° N. latitude and its most northern point a little north of 48° N. No part of the province is so far north as Paris. St. John, the chief port of the province is in latitude 45° 16′ 4″ N., a little farther south than Venice, which is in latitude 45° 25′ 53″ N.

To the southwest of the mainland of New Brunswick is a group of small islands belonging to the province, the most important being Campobello with an area of 115,000 acres, Grand Manan with an area of 37,000 acres and the West Isles having an area of 8,000 acres. Grand Manan Island is larger than the Isle of Jersey in the English channel. The total land area of all the Channel islands is 48,083 acres and the population is about 100,000. This group of New Brunswick islands in the bay of Fundy with an area over three times as great as the Channel islands has a population of between five and six thousand, most of whom are fishermen. The soil of the islands is generally fertile, but only a small proportion of it is under cultivation.

NEW BRUNSWICK'S CLIMATE.

There is a pronounced difference between the winter climate along the bay of Fundy coast and that of the interior and northern counties. According to the Dominion meteorological records for a period of seven years the minimum temperatures of St. John averaged: In January and February -14·5°; March -3·1°; April 16·5°; May 30·1°; June 39·9°; July and August 44·6°; September 35·1°; October 25·8°; November 10·6°; December -1·6°. The average of all temperatures for seven years was in January and February 17·9°; March 26·4°; April 37·3°; May 47°; June 56·1°; July and August 60·4°; September 54·4°; October 45·2°; November 36·1°; December 24·3°. The average of maximum temperatures for seven years was: In April 60·7°; May 69·5°; June 77·5°; July and August 83·8°; September 75·3°; October 63·1°; November 56·9°. At Fredericton, the capital, not far from the centre of the province, the greatest degree of cold in an average winter is between 25 and 26 degrees below zero, the average of all temperatures during January and February for seven years being between

12 and 13 degrees above zero, while at Bathurst on the bay of Chaleur the greatest degree of cold in an average winter is 22 degrees below zero, and the average of all temperatures during January and February for seven years was about one degree lower than that of Fredericton.

BAY OF FUNDY TIDES.

The most important seafront of New Brunswick is along the bay of Fundy, for this great inland sea gives the province a winter port which is always open. The bay of Fundy, which almost completely separates Nova Scotia and New Brunswick is noted the world over for its peculiar tides, which are generally supposed to be even more extraordinary than they really are. They are often said to rise as high as seventy feet, whereas official records show that they never exceed fifty-five feet at any point and do not average more than thirty feet. The highest rise is along the Chignecto Isthmus and in the Basin of Minas on the Nova Scotia side. At St. John, the winter port of New Brunswick, the spring tide is twenty-seven feet and the neap tide twenty-three feet. The great tidal waves, rushing up the rock-bound bay turn inward wherever they find an opening made by a river, and ascend its channel under the name of tide bores, so that in Nova Scotia river beds, which ordinarily contain nothing but rivulets, are full of water at flood tide. On the New Brunswick side the rivers, being much more important, do not dwindle to rivulets when the tide is out, but there is a very great difference in the volume of water near their mouths at high and low tides. When the tide is out vast muddy flats are left bare, and it is only during spring tide that they are entirely covered. Thousands of acres of these marsh lands near the river mouths, both in Nova Scotia and New Brunswick have been reclaimed by dyking, and the land thus made available for agriculture is of extraordinary fertility, producing astonishing crops for years without manure. The alluvial mud is sometimes carried to the uplands to be used as manure.

NEW BRUNSWICK'S GREAT RIVERS.

The most notable feature of the province of New Brunswick is its extensive system of navigable rivers. The chief of these is the St. John, which is navigable for large steamers as far as Fredericton, the capital of the province, 85 miles above St. John city, and for lighter craft as far as the Grand Falls, 225 miles from the sea. It receives a number of navigable tributaries, including the Tobique, Madawaska, Aroostook, Keswick, Nashwaak, Oromocto, Nerepis and Kennebeccasis rivers. In the lower part of its course it is very wide and remarkably deep, but before reaching the harbour of St. John it contracts and passes between two perpendicular cliffs, only three hundred feet apart. About a mile above the harbour of St. John a ledge of rock stretches across the river forming a dam and a waterfall which under ordinary circumstances would necessitate the construction of a canal, but a sort of natural lock is formed by the tides; for at high tide the water level of the harbour is higher than that of the gorge, so that there is a fall inward instead of outward, and at half tide during both rise and fall the water in the gorge is level with the harbour and vessels can pass through in safety. One of the most important tributaries of

Scene on the St. John River near Fredericton.

A New Brunswick Farm.

the St. John river is the Kennebeccasis, which is about 100 miles in length and is very wide in its lower reaches. Besides the St. John, the bay of Fundy receives the waters of the St. Croix, the Petitcodiac and a number of smaller rivers. The other important rivers of the province are the Miramichi, Richibucto, and Nepisiquit, emptying into the gulf of St. Lawrence, and the Restigouche, flowing into the bay of Chaleur. Excepting the St. Croix, which is only navigable for sixteen miles from its mouth on account of rapids, all these rivers are navigable for many miles and most of them have a number of navigable tributaries, so that almost every part of the province has communication with the sea. In many cases the headwaters of the navigable rivers are so close together that short canals would connect them and it is possible that at some future time all the important rivers of the province will be connected, making a network of waterways. In the southwestern part of the province are a number of small rivers with many lake expansions.

THE LAKES OF NEW BRUNSWICK.

New Brunswick has no large lakes, but there are many beautiful little lakes which afford opportunities for boating and fishing. The largest lake of the province is Grand lake, which is 20 miles long, about 5 miles wide at its widest part and has an area of 74 square miles. Grand lake is connected with the St. John river by the Jemseg channel, three miles in length.

RICH FARM LANDS.

There are 17,910,400 acres of land in the province, and it has been estimated by experts that over thirteen million acres are suitable for agriculture. Of the remaining acreage a considerable portion could be made available for agriculture by drainage. Millions of acres in the most fertile sections still belong to the Crown and can be obtained by settlers as free grants. While there is much good farm land in every county the counties having the largest areas of fertile land are Carleton, Victoria, Madawaska, Restigouche, King's and Queen's. The recent construction of railways has made much of this land that was formerly inaccessible available for settlement. The rivers of New Brunswick run through tracts of low-lying alluvial land of remarkable fertility, sometimes extending for miles back from the river, but generally less than a mile wide. These low lands, which are called intervals, are partly covered with water in the spring. Without dyking and without manure they produce great crops of fine hay every year. When dyked and brought under cultivation they prove to be remarkably fertile. New Brunswick has so many great rivers that the area of intervals is extensive, but these lands are usually attached to upland farms.

Professor Nathaniel S. Shaler, of Harvard University, who is regarded as a high authority on agricultural matters, has said of New Brunswick: "It is a splendid agricultural country, much finer than any section of the New England States."

Although the province of New Brunswick is well suited to wheat production, the quantity grown is not large, as the farmers consider it more profitable to grow oats, hay, buckwheat, potatoes and other vege-

tables. A good deal of attention is now being paid to fruit growing, and very fine apples, pears and plums are produced, while the smaller fruits such as cherries, raspberries, blackberries and blueberries, are raised in large quantities. There are no great orchard districts in New Brunswick such as are seen in the Annapolis Valley of Nova Scotia, but many of the farmers have small orchards, and as expert horticulturists have declared that nearly every part of the province is well suited for apple production the Government Agricultural Department is urging the farmers to plant apple trees. New Brunswick seems to be particularly adapted to dairying on account of the luxuriant pasturage, unfailing supplies of water, and nearness to the markets of both Europe and the Eastern States. The report of the expert commissioners appointed by the Dominion Minister of Agriculture to investigate conditions affecting the sheep industry in Canada referred to New Brunswick as a "country with high, rolling hills and well-watered pastures growing various kinds of short, sweet, natural grass and white clover specially adapted for sheep."

NEW BRUNSWICK FISHERIES.

The fisheries of New Brunswick give employment to a large number of people all along the coasts of the province, the fish caught including herring, lobsters, sardines, smelt, codfish, salmon, haddock, tomcod, alewives, hake, oysters, shad, pollock, clams, mackerel, sea bass and eels. Fuller information about these fisheries will be found in Chapter XIII, devoted to the fisheries of Canada. The rivers and lakes of New Brunswick are famous for their salmon and trout, which annually attract many sportsmen from the United States and the United Kingdom.

HUNTING GROUNDS.

The hunting grounds of New Brunswick also attract many sportsmen. As a result of the game protection laws, moose, caribou, and deer have greatly increased in numbers, and it is claimed that there is more big game to the square mile in this province than in any other part of America.

THE FORESTS OF NEW BRUNSWICK.

The trees of New Brunswick include spruce, white pine, hemlock, balsam fir, birch, cedar, maple, beech, aspen poplar, balsam poplar, jack pine, red pine, ash, basswood, tamarack, butternut, oak and elm. At one time New Brunswick was noted for its immense forests of white pine and the exports of pine timber, pine boards, shingles, staves, masts and spars were very large. Partly as the result of indiscriminate cutting and partly because of great forest fires the pine forests have to a large extent disappeared, but the area of the spruce forests has greatly increased, spruce trees having grown up on lands formerly occupied by pine. The annual cut of spruce is now about ten times as great as the cut of pine.

COAL, IRON AND LIMESTONE.

According to geologists there are possibilities of coal discoveries in portions of nine counties of New Brunswick, viz.: Gloucester, Northumberland, Westmoreland, Albert, Kent, Queens, Kings, Sunbury and York,

but the seams so far discovered are very thin compared with those of Nova Scotia. The coal is bituminous, being similar in quality to Nova Scotia coals. At present the only producing mines are in the vicinity of Grand lake in Queens county and Sunbury county, where coal is estimated to underlie an area of about 100 square miles. The coal measures are very nearly flat, and lie quite close to the surface. There are two seams mined, one from 20 inches to 24 inches and the other from 6 inches to 10 inches thick. In many places the two seams are only separated by about six inches of shale.

There are deposits of peat in St. John, Gloucester, Northumberland and Kent counties.

Many small deposits of iron ore have been found in different parts of the province of New Brunswick. The most important so far discovered are those in the Austin Brook district of Bathurst county, where mining experts state that great masses of iron ore have been proved. In a report prepared for the Department of Mines, Mr. Einar Lindeman, M.E., who surveyed about two square miles of the district in 1906 and 1910 described this ore as a very fine-grained silicious magnetite mixed with a considerable amount of hematite, the metallic iron content of the various layers ranging from 59 down to 35 per cent, the average being about 43 to 47 per cent, while the average phosphorous content is about 0·8 per cent with the sulphur ranging from 0·03 to 0·1 per cent. Other mining engineers have expressed the opinion that immense quantities of ore are available. The only producing mine is the Drummond on the Nepisquit river which is equipped to produce 1,000 tons per day. There is a railway about 17 miles long connecting the mine with the Intercolonial railway which carries the ore to Newcastle on the Miramichi river for shipment. Including 17 miles haul on the mines railway and about 39 miles on the Intercolonial the rail haul from the mines to deep water at Newcastle is about 56 miles. As a considerable percentage of the ore is low grade it is treated in a concentrating mill, and the average metallic iron content of the ore marketed has been 48 per cent, with a manganese content of 2·5 per cent, making a total metallic content of 50·5 per cent. In Carleton county near Woodstock there is iron ore of good quality which was smelted with charcoal in the early days, but no mining has been done for years. There is iron ore in St. John's county within twelve miles of the city of St. John, but the extent of the deposits does not seem to have been ascertained. So little mining exploration work has been done in the province of New Brunswick that it is quite possible that very extensive deposits of iron may yet be discovered.

Limestones are found in Charlotte, Kings, Albert, Carleton, Victoria, Madawaska and Gloucester counties, the finest deposits worked being those in St. John county, which are very extensive.

Although New Brunswick has coal, iron and limestone, the three raw materials of iron manufacture, there are no blast furnaces in the province.

OTHER MINERALS IN NEW BRUNSWICK.

Antimony has been found in considerable quantities in the parish of Prince William, about 25 miles from Fredericton and three miles from the St. John river. The Canadian Antimony Company have a small reduction plant there. There is also antimony in King's county.

Many small deposits of copper have been found in different parts of the province, but none of them have been considered sufficiently large to be worth working.

New Brunswick is not a producer of either gold or silver although small quantities of gold have been found in the washings of some of the rivers.

There are indications of lead in different parts of the province, but no important deposits have been found.

Pyrrhotites containing small quantities of nickel are found near St. Stephen.

Graphite exists in the counties of St. John, Charlotte, Kings and Westmorland, but the extent of the deposits is unknown. The St. John county deposits were worked on a small scale for some years, but working is said to have been abandoned on account of water getting into the shaft.

Grindstones are manufactured at several points in Westmorland county, Gloucester county and Northumberland county from the millstone grit quarried in the neighbourhood of the works.

Gypsum of very fine quality is mined in Albert, Victoria, St. John, Westmorland and Kings counties, the most extensive deposits worked being those in the vicinity of Hillsborough in Albert county, where there are seven quarries and large quantities are ground, calcined and shipped out in barrels.

Manganese is found in Kings, St. John and Albert counties and some of the deposits are said to be extensive.

New Brunswick is noted for its building stones which have been used in many fine buildings in cities of central Canada and in the United States. Granite is quarried near St. George's, Charlotte county, and at Hampstead, Queens county. Northumberland and Westmorland counties have sandstone quarries.

Clay for the manufacture of bricks is found in abundance in the counties of St. John, York, Northumberland and Westmorland and the bricks are manufactured quite extensively.

The shale overlying the coal measures in the Grand Lake district which has to be removed in mining the coal is very suitable for the manufacture of highly finished facing brick, sewer pipe, mantels, and other vitrified products. It takes a very fine glaze and becomes extremely hard. Treated in a different way it could be used for many purposes where a semi-refractory brick is called for such as boiler settings, coke oven blocks, stove linings, etc. At present it is a waste product piled up in great dumps near the coal mines, but Mr. J. Keele of the Canadian Geological Survey submitted it to numerous tests with highly satisfactory results.

Important deposits of tripolite or infusorial earth have been found covering the bed of the Pollet River lake and Pleasant lake in King's county.

Experiments have shown that fine paints can be made from the stibnite deposits of Prince William, the chalcocite deposits at Dorchester in Westmorland county, the manganite at Mount Jordan in King's county, the bog manganese at Mechanic's Settlement in Albert county and the ferruginous clay of Chaplins' island, Northumberland county. It is believed that large quantities of such mineral pigments are obtainable in various parts of the province, furnishing materials for an important paint industry.

NATURAL GAS AND OIL.

In Albert county about eleven miles from Moncton and in the adjoining part of Westmorland county there is an extensive gas field. There are already a large number of gas-producing wells and new wells are being drilled. The city of Moncton is supplied with gas for light and power from these wells. Petroleum is also being pumped in this locality in small quantities. There are extensive beds of oil-bearing shales in both Albert and Westmorland counties, and it is proposed to establish a plant for the extraction of oil from these shales. It is believed that a plant having a capacity of treating 2,000 tons of shale per day will yield approximately 80,000 gallons of crude oil daily. The oil is of good quality.

THE CITY AND PORT OF ST. JOHN.

St. John, the metropolis of New Brunswick, is situated at the mouth of the St. John river, which with its lake expansions and numerous affluents, makes all the central and northwestern counties of the province tributary to the city during the season of inland navigation. The ice which forms in the river St. John is held back by the Narrows above the city, and the high tides make it impossible for ice to form in the harbour itself at any season of the year, so that the harbour is not only never frozen over but it has never been obstructed by floating ice at any time during the whole history of the port.

A glance at the map will show that the harbour or bay of St. John is quite extensive, being well protected on the east by cape Mispec and on the southwest by a breakwater and Partridge island, but the shipping facilities of the port of St. John are concentrated around two inner harbours. Each of these inner harbours is about two miles long and about three-quarters of a mile wide. Owing to their shape they have been compared to horseshoes, bringing good luck to the city that is growing around them. The original city of St. John was built on a narrow neck of land between the old harbour of St. John and Courtenay bay, which was then quite shallow at low tide, but recently Courtenay bay has been dredged by the Canadian Government and it is now known as the Eastern harbour of St. John, while the old harbour is called the Western harbour. The Canadian Pacific railway which has for a number of years made St. John its chief Atlantic port, has its terminals on the west side of the western harbour; the Government railway system has terminals on both harbours.

There has always been rivalry between Halifax and St. John for the honour of being the winter port of Canada. As the commerce of Canada develops the facilities now being provided at both ports will be required. Halifax has the advantage of being nearer to England than St. John, but St. John has the advantage of being nearer the centre of Canada. Halifax claims that it offers greater advantages for the landing of passengers and mails; St. John claims that the shorter railway haul to the west makes it the natural Canadian winter port for freight. The Canadian Pacific Railway chose St. John as its Atlantic port because it is the nearest open winter port to Central and Western Canada. The ocean voyage from

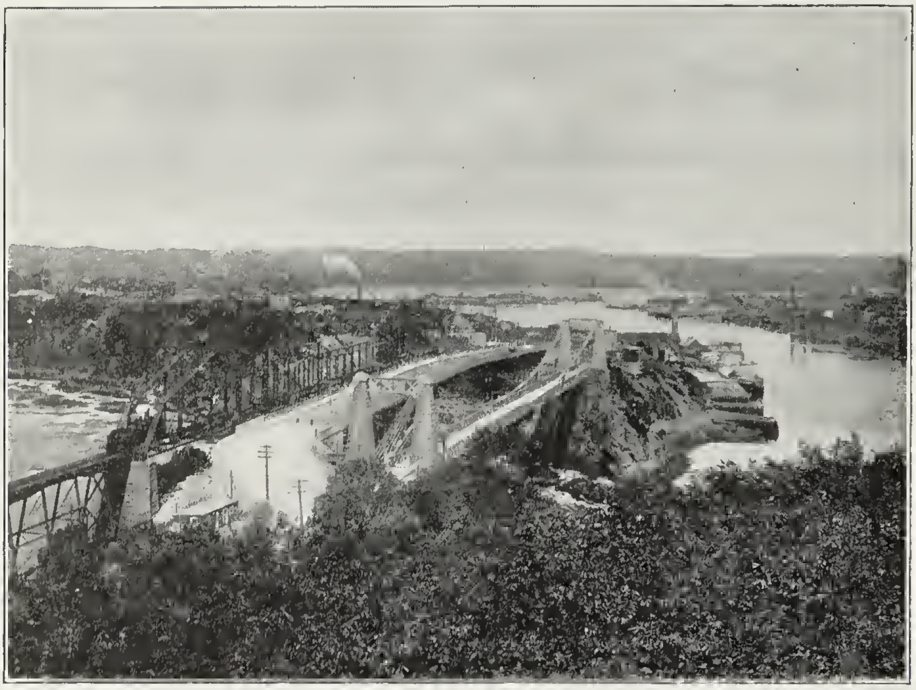
Centre of western harbour, St. John, N.B.

A bit of the harbour front, St. John, N.B.

Liverpool to St. John is over 200 geographical miles longer than to Halifax, but nearly 400 miles shorter than to New York, nearly 200 miles shorter than to Boston and about 156 miles shorter than to Portland, Maine. The distance to Montreal by the Canadian Pacific railway is 481 miles, the distance from Halifax to Montreal by the same route being 758 miles. By the Intercolonial railway the distance from St. John to Montreal is 740 miles, compared with 836·3 miles from Halifax to Montreal. At present the National Transcontinental railway only reaches Moncton, connection with St. John and Halifax being made by the Intercolonial from Moncton. The distance from St. John to Quebec city by the National Transcontinental railway is 555·3 miles, as compared with 651·6 miles from Halifax by the same route, but it is expected that a short line will be constructed to St. John from some point on the Transcontinental railway, which will considerably reduce the distance between St. John and Quebec city. The actual distance from Liverpool to the American cities of Detroit and Chicago and all the United States to the west and northwest of them is twenty-four miles less by way of St. John than by way of New York. The exports through the port of St. John were nearly six times as great in 1913 as they were in 1896. In 1914 there was a slight falling-off, but the exports were about five times as great as in 1896. As regards the safety of the route to St. John through the bay of Fundy, statistics prepared by the St. John Board of Trade from Government returns of wrecks show that during the eighteen years ending with 1914, with a total tonnage of 42,029,262 tons entering the port of St. John, the casualty average was only ·033 of one per cent. This statement covered all mishaps as far as cape Sable, and seems to establish the safety of the route to St. John through the bay of Fundy. The bay of Fundy not only gives New Brunswick and all Canada a convenient outlet to the Atlantic but places St. John in a most favourable situation for trade with all the western coast of Nova Scotia, including the fruitful Annapolis Valley. The advantageous geographical situation which St. John enjoys for the development of trade with the outside world was shown in the table of distances in Chapter II. The terminal facilities are being continually improved as the business of the port increases. At present the west side of the old harbour is equipped with eight deep-water berths ranging in length from 600 to 700 feet with 34 feet of water at extreme low tide, while on the eastern side the Intercolonial railway has four deep-water berths. There are also a number of private wharves available for coast shipping. The Canadian Pacific railway has two million bushel grain elevators at its west side terminals, and the Intercolonial railway is about to build a large modern grain elevator at its deep-water terminals in this harbour. In the Courtenay Bay harbour there are under construction a breakwater a mile and a quarter long, a dry dock 1,150 feet long and 110 feet wide, and 23 berths to range from 700 to 1,000 feet long with 35 feet of water at extreme low tide.

OTHER TOWNS OF NEW BRUNSWICK.

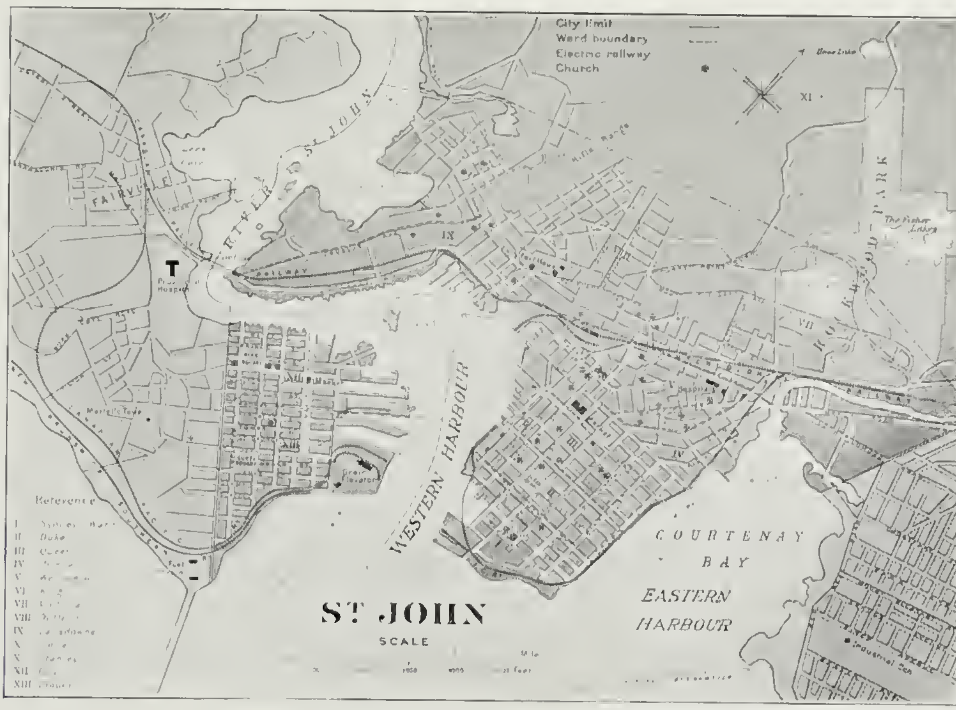
Fredericton, the capital of New Brunswick and seat of the Provincial University, is beautifully situated on the St. John river, 84 miles above St. John. It has wide streets and many beautiful residences. Its indus-



Bridge over reversing falls, St. John River.

C.P.R. deep water piers and elevator, St. John, N.B.

tries include tanneries, canneries and woodenware factories. The population was 7,208 in 1911. Moncton, on the Petiteodiae river, is the headquarters of the Intercolonial and National Transcontinental railways. Its population was 11,345 in 1911 and has grown rapidly since the census. In addition to the railway workshops it has large stove founderies, engine and boiler works. Owing to its central position, its excellent railway facilities, its nearness to the coal of Nova Scotia and an abundant supply of natural gas in the enighbourhood, it is likely to become an important manufacturing city. Chatham and Newcastle, close together on the Miramichi river, had, respectively, 4,666 and 2,945 citizens in 1911. Other good towns are Woodstock with 3,856, Campbellton with 3,817, St. Stephen with 2,836, and Sackville with 2,039 citizens in 1911.



The two harbours of St. John.

Montreal harbour, near entrance to Lachine Canal.

Chapter VI.

THE PROVINCE OF QUEBEC.

The province of Quebec might with accuracy be included among the Maritime Provinces, for the gulf of St. Lawrence is really a part of the Atlantic and salt water washes the sinuous coasts of the province for many miles. The influence of the tide is felt in the St. Lawrence river at the port of Three Rivers, 900 miles from Belle Isle, and although the great blue river is estimated to pour two million gallons of fresh water into the gulf every minute, the water is salt at St. Thomas, about thirty-six miles below Quebec city and at Kamouraska, about forty miles farther down, salt was manufactured from the water by evaporation during the French regime. Then the territory of Ungava which has recently been added to Quebec province has a very long coast line on Hudson bay, Hudson strait and Ungava bay.

Before Ungava was placed under the jurisdiction of Quebec the area of the province was 351,873 square miles. Now it is 703,653 square miles almost double its former area. Including Ungava, Quebec province is larger than Belgium, Holland, Germany, Denmark, Sweden, Austria-Hungary and Bulgaria combined which had a population of over 140,000,000 before the great war began. Without Ungava Quebec is as large as Germany, Holland, Belgium and Italy combined.

THE ST. LAWRENCE RIVER.

The St. Lawrence from the gulf to Traverse is from ten to thirty-five miles wide and very deep. It is skirted on the north by the Laurentian mountains, which rise in some places near the shore to heights of over 2,500 feet, and on the south by the Alleghanies, whose peaks attain a height of nearly four thousand feet within a few miles of the river. Between these mountains the great river and the sea mingle together in such a way that no man can tell where river ends and sea begins. There are many depressions in the mountains to let the tributary rivers through, and at Tadousac, about 122 miles below Quebec city, some great convulsion of nature has cleft a chasm through a mountain and almost into the bowels of the earth, giving vent to the Saguenay, believed to be the deepest river in the world. The peaks of the divided mountain are known as Cape Trinity and Cape Eternity and rise to heights respectively 1,800 feet and 1,600 feet above the level of the river. The bottom of the chasm through which the Saguenay flows is six hundred feet below the bed of the St. Lawrence and for over sixty-three miles the sea surges between mountains to meet the river coming down from lake St. John, affording navigation for large ocean vessels, while river steamers can ascend to Chicoutimi eight miles farther up, and no doubt the Saguenay could be made navigable for large ocean vessels as far as Chicoutimi.

Two central piers of Montreal's seven miles of wharves.

About 60 miles below Quebec city, the St. Lawrence river contracts and the mountains trend away to the north and south, leaving a fertile alluvial valley stretching to Montreal. Above Quebec the river is generally about two miles wide, but sometimes contracts to one mile, while here and there it expands to a greater width than two miles. While the general depth of the river is from 45 feet to 100 feet to a point about 45 miles above Quebec city and 30 to 50 feet from there to Montreal there are a number of shoal places and to enable modern ocean vessels to reach Montreal it has been necessary to dredge channels through these shoals. The longest shoal is where the river expands to form lake St. Peter which is nine miles wide, twenty miles long and has a general depth of from eleven to eighteen feet, with a few deep pools.

It is seventy years since the dredging of a channel through the shoals was first begun and it did not require to be very deep to accommodate ocean going vessels of that day, but as the size of ocean vessels has increased the channel has been deepened and widened. Now ships drawing thirty feet of water can go up to Montreal at extreme low water. The intention is to eventually have a channel nowhere less than 35 feet deep. The whole St. Lawrence channel is splendidly equipped with buoys and lights, so that navigation is very safe.

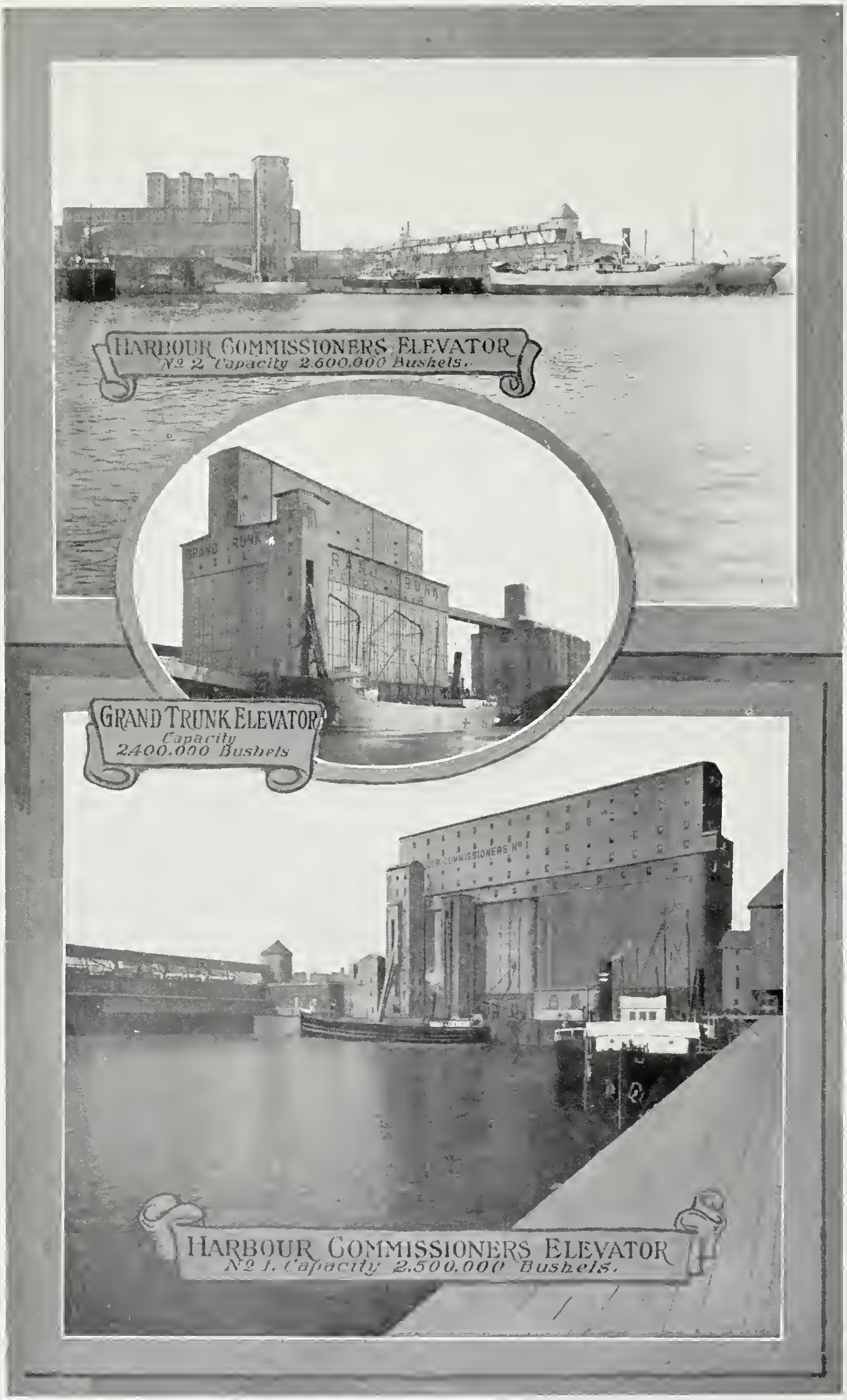
The character of the river bottom is such that when the channel is once made it is permanent and there is no difficulty in keeping it always clean and clear.

The season of navigation on the St. Lawrence varies somewhat in different years. A record of the opening and closing of navigation at the city of Quebec for one hundred and one years from 1814 to 1914 inclusive shows that the earliest date for the opening of navigation for ocean vessels was April 9, and the latest May 11, while the earliest closing was November 21, and the latest December 13. The opening of navigation is very seldom later than the last week of April.

At Montreal the record does not extend over so long a period, but for 36 years from 1879 to 1914 inclusive the earliest opening of navigation for river craft was March 31, and the latest May 5, while the earliest closing of navigation was December 2, and the latest the end of the first week in January. The earliest date for the arrival at Montreal of the first vessel from sea during the same period of 36 years was April 11 and the latest March 6, while the earliest date for the last departure of vessels for the sea was November 20 and the latest December 4.

But many people believe that the season of navigation might easily be extended. The river below Quebec city is open throughout the year, but navigation is somewhat obstructed in winter by floating cakes of ice and along the south shore ice forms in all the harbours. On the north shore for some reason the water is more salt than on the south shore, and the prevailing winds being from the north, what ice forms in winter usually drifts over to the south shore; but the Intercolonial railway runs along the south shore and the channel on that side is better lighted and buoyed, so that it is usually taken by vessels.

In the gulf of St. Lawrence navigation seems to be most liable to obstruction in the early spring, when the ice in the many bays along the coast breaks up and floats out. Between Quebec city and Montreal the



Some of Montreal's great elevators.

channel does not freeze until an ice bridge is formed by jams of floating ice from the lakes above or from along the shore. It has been argued that by means of cribs in lake St. Louis above Montreal, an ice bridge could easily be formed at the beginning of the season, which would prevent the lake ice coming down to the harbour, and that if the lake ice were kept back there would be little difficulty in keeping the channel open below Montreal with ice-breaking vessels. Many other plans have been proposed but there is little likelihood that ocean vessels will ever run to Montreal throughout the year, although the season of navigation may be prolonged for several weeks.

OTHER RIVERS OF QUEBEC.

Besides the St. Lawrence and its greatest tributary the Ottawa, which, forming the boundary between Quebec and Ontario for many miles, cannot be included among the rivers belonging exclusively to Quebec, this province has 185 other rivers with an aggregate length of over 15,995 miles, without including any of the rivers of Ungava, north of the East Main river. Because of the numerous rapids very few of these rivers are navigable for long distances, but the rapids do not offer any serious obstacle to floating timber, and they furnish a great number of water-powers for manufacturing purposes. The Ottawa, St. Maurice, Yamaska, St. Francis and Richelieu are navigable for many miles.

THE LAKES OF QUEBEC.

The lakes of Quebec have never all been named or numbered. There are a very large number of small lakes. Many of them are merely expansions of the rivers, others are river reservoirs receiving the waters of a number of small rivers and emptying them through one larger river into the St. Lawrence or one of its tributaries, or sometimes into one of the rivers flowing toward Hudson bay. Many of the small lakes are noted for their beauty. The two most important lakes in the old province of Quebec are lake Mistassini and lake St. John, out of which flows the Saguenay river.

THE CLIMATE OF QUEBEC.

A territory so vast in area of course has a varied climate. At Montreal, according to the meteorological records for a period of seven years the greatest degree of cold experienced during January and February of an average winter is -22·6°; March, -8·9°; April, 13·5°; June, 45·4°; July and August, 46·9°; September, 36·7°; October, 25·1°; November, 8°, and December, -14°. The average of all temperatures for seven years was in January and February, 11·4°; March, 20·9°; April, 37·8°; May, 53·8°; June, 64·9°; July and August, 67·4°; September, 57·3°; October, 44·5°; November, 32·2°; December, 17·7°. The average maximum temperature for seven years was in April, 67·6°; May, 77·9°; June, 85·3°; July and August, 85·5°; September, 79·6°; October, 68°; November, 59·4°. In Quebec city the greatest degree of cold experienced during the months of December, January, February and March is between one and two degrees lower than in Montreal. The average of all temperatures during January and February is several degrees higher than in Montreal, but in all the other months the average temperature is several degrees

lower than at Montreal, and the season without frost is nearly three weeks shorter. The lake St. John district affords a very good illustration of the fact that climate depends more upon local influences than upon latitude. Although about one hundred miles north of Quebec city, its temperatures average several degrees higher and the summer is several weeks longer. There is a large area of good farm land in this district. In the vicinity of lake Timiskaming, on the boundary of Ontario, about three hundred miles northwest of Montreal, the climate is about the same as at Quebec city. Explorers report that on the slope toward James bay the climate is better than immediately south of the watershed and that a great deal of land is suitable for cultivation.

As regards the climate, soil and natural resources of Ungava, almost nothing is known. The fisheries are undoubtedly rich, fur-bearing animals are supposed to be numerous, and there are believed to be valuable minerals, but little can be said about a country the greater part of which has never been visited by explorers.

FARMING IN QUEBEC.

The section of the province bordering on the lower St. Lawrence, partly owing to its mountainous character and partly to the influence of the Arctic current, flowing through Belle Isle, has a rather severe climate and is not generally well suited to agriculture. The mainland northeast of Anticosti island is little better than Labrador. Anticosti itself is believed to possess considerable areas of good land. West of that the climate is better and there is a good deal of fertile land in the valleys. The islands in the river west of Anticosti are all fertile. The isle of Orleans, a little below Quebec city, has always been noted for its grapes.

The best agricultural region of the province is the fertile valley extending on both sides of the St. Lawrence river from Montreal to Quebec city and reaching as far east as Kamouraska on the south shore, with an area about the same as that of Holland. The greater part of the present population of the province is concentrated in this valley. Throughout the St. Lawrence valley apples, pears, plums and cherries are grown, while grapes are produced in the open air as far west as L'Islet, on the south shore of the St. Lawrence, 70 miles northeast of Quebec city, and even peaches are being successfully grown in a small area in the southwestern end of the valley. Large quantities of strawberries, currants, gooseberries and other small fruits are produced. It was once a great wheat region but comparatively little wheat is grown now. Great quantities of oats, hay, clover and potatoes are produced, and a considerable acreage is devoted to barley, buckwheat, rye, Indian corn, peas and beans. A small quantity of flax is grown. Nearly every farmer in Quebec province grows a little tobacco and there are a few large plantations. About ten million pounds of tobacco are grown annually in this province. Very small quantities of hops are grown.

A large proportion of the farms have groves of sugar maple trees and considerable quantities of maple sugar are produced, the sap flowing freely in the early spring when there is frost at night and bright sunshine during the day.

The province of Quebec has achieved marked success in dairying and there is room for great expansion of this industry. Good grazing land, watered by springs, streams and lakes, abounds almost everywhere from lake St. Francis to the extremity of Gaspé. It is not and never can be a ranch country; the snow lies too deep in winter, but nearness to the markets of Europe as well as to those of industrial Canada largely offset the cost of winter feeding and housing. Dairy farming is now attracting special attention, and in the district between the St. Lawrence river and the United States boundary, commonly known as the Eastern Townships, there are already many fine herds of cattle with some of the best blood in America. Quebec ranks second among the provinces of the Dominion in the production of butter, cheese and condensed milk.

THE FORESTS OF QUEBEC.

Estimates regarding the extent of the forest resources of Quebec do not include the newly added territory of Ungava, but it is not considered that the forests of that territory are very extensive. The forestry experts of the Quebec Government estimate that the forests of the old province of Quebec contain 50,000,000,000 feet board measure of white and red pine, 125,000,000,000 feet of spruce and balsam fir, 100,000,000,000 feet of pulp wood and 35,000,000,000 feet of hard wood, birch, maple, etc., 20,000,000,000 feet of cedar, a total of 330,000,000,000 feet board measure. The forests of the province are divided into five classes according to their tenure:

	Acres.
Forests leased as timber limits..	44,500,000
Forests not in timber limits..	78,000,000
Private forests..	6,000,000
Forests on lots under location ticket..	1,300,000
Township forest reserves..	200,000

The private forests are of three classes, old seigniories, lands sold to settlers by the government and lands granted to railways in aid of their construction. The greater part of these private forests lie in the central valley of the St. Lawrence and are usually divided into small properties, seldom exceeding 50 acres with the exception of railway lands and a few large seigniorial domains. The public forests not under license are generally farther back from the St. Lawrence than those under license, some of them being north of the height of land which divides the waters flowing into the St. Lawrence from those flowing toward Hudson bay. No cutting has ever been done in these vast forests, but they have often been ravaged by fires. They are now under the direction of the forest service of the province and in future measures will be taken to prevent fires so far as possible. The forests on lots under location consist of lots of 100 acres each sold to settlers at from 30 to 60 cents per acre on condition of performing certain settlement duties. Settlers patents are not issued until five years after the date of sale and in the meantime the settler is obliged to build a house and barn, clear not less than three acres and not more than five acres annually and cultivate the land he clears. When these conditions are complied with the settler is given full possession of the lot and the portion of it that remains uncleared is included among the private forests. The township

forest reserves consist of lands in certain townships which being considered more suitable for permanent forests than for cultivation have been set aside as forest reserves in statistical reports.

Among the trees of Quebec province are spruce, white pine, hemlock, birch, balsam fir, basswood, red pine, maple, cedar, ash, elm, aspen poplar, balsam poplar, cottonwood poplar, beech, tamarack, jack pine, oak, butternut, cherry, hickory. The cut of spruce exceeds that of all other woods. Next in order come white pine, hemlock, birch and balsam fir.

NO COAL IN QUEBEC.

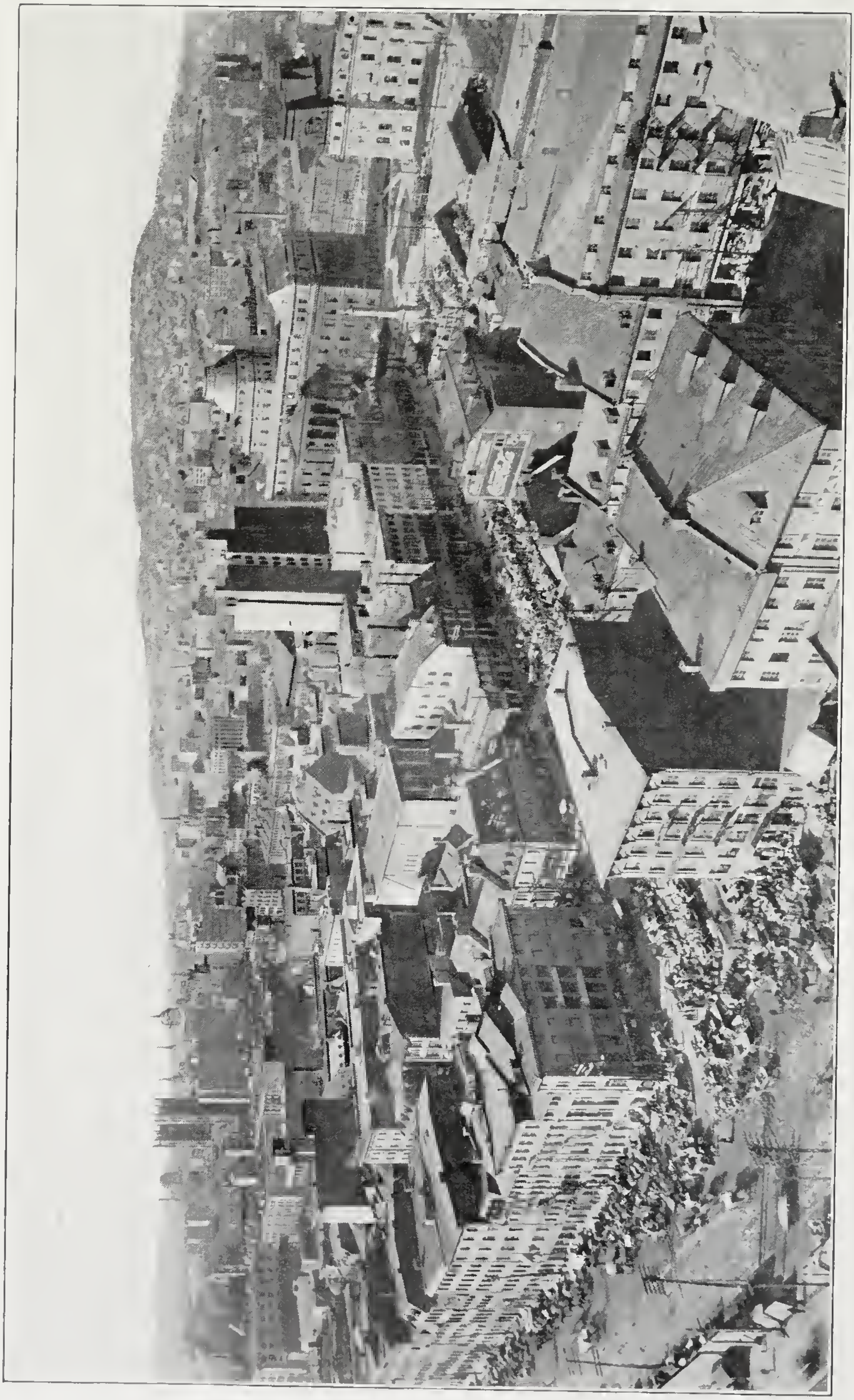
Geologists say that no coal will ever be found in the province of Quebec south of the height of land which divides the waters flowing toward Hudson bay from those flowing into the St. Lawrence river. There are possibilities of coal discoveries north of the height of land. Peat of good quality abounds, being widely distributed throughout the province.

QUEBEC IRON ORES.

No very large bodies of good iron ore have been proven to exist in the province of Quebec, although there are widespread indications of iron, but it is possible that extensive beds of iron ore may yet be discovered or that some of the known deposits now regarded as doubtful may prove to be of great value. There is some reason to believe that there may be extensive iron ore deposits along the Gatineau river in Hull township, Ottawa county, within a few miles of the city of Ottawa. Many years ago three mines were opened in what is known as the Hull range, viz., the Forsyth, Baldwin and Lawless mines. From the Forsyth mine 8,000 tons of ore were shipped to Cleveland, Ohio, between 1854 and 1858, averaging it is said over 60 per cent in metallic iron. The ore was magnetite, low in phosphorus and sulphur. Shipments ceased because supplies of ore more conveniently situated for transportation to the Cleveland market were discovered. Mr. Fritz Cirkel, M.E., of the Dominion Department of Mines, who recently made a report covering 147 pages on the deposits along the Ottawa and Gatineau rivers, thinks it probable that there may be a large body of ore in the Forsyth, and says that while the Baldwin deposits seem to be more irregular and to consist largely of pockets, the quantity of ore exposed, although scattered, is of sufficient importance to justify mining operations on a large scale. Of the Lawless mine, he says that no solid ore bed of any extent can be seen on the surface, but there are some pockets of very good quality. He states that the principal constituent of the ores of the Hull iron range is magnetite, intermixed at some places with hematite and associated with a gangue material, and that they contain from 53 per cent to 67 per cent of metallic iron, the highest percentages being obtained from magnetite ores free from hematite. The ores are very low in phosphorus. Sulphur is present in the form of pyrites and is in some cases confined only to the edges of the deposit. Mr. Cirkel believes that in actual mining these parts of the deposits can be passed by or the pyrites can be eliminated by cobbing. The iron-bearing area is estimated as having approximately a length of 6,800 feet, while the width ranges from 40 feet to 100 feet. The deposits are numerous in the eastern portion of the range, but thin out in the extreme western portions. In the township of Templeton, near

the boundary of Hull township, is the Haycock mine, where in April, 1873, rather extensive mining operations were begun and continued for several years. Mr. Cirkel reports that all the deposits he examined so far as surface indications go are of limited extent, but he thinks it possible that large ore bodies may be found in the neighbourhood. The Hayeock ore is hematite, being sometimes an admixture of magnetite, and samples taken from a number of pits indicate that it has a high percentage of iron, being low in both phosphorus and sulphur, but high in titanic acid. There are several other iron ore deposits in the vicinity whieh appear to be of much the same character. There are many small outerops of both magnetite and hematite in the different townships bordering on the Gatineau river, but the value of the deposits cannot be determined without development work. The Bristol iron mines are in the township of Bristol, county of Pontiac, about two miles north of the Ottawa river and a little over four miles from the Wyman station on the Canadian Pacifie railway. Between 1885 and 1888 shipments of iron ore were made from this mine to Pennsylvania furnaces, but no mining has been done sinee. Samples of ore analyzed show that it is high in metallic iron, very low in phosphorus, somewhat high in sulphur and contains a very small percentage of titanic aeid. The ore is a mixture of crystalline magnetite and hematite of varying proportions. This ore might have to be roasted to reduce the sulphur content. The Bristol iron-bearing formation has an approximate length of 1,500 feet and an approximate width of 500 feet. An examination of the abandoned mine showed that in the main shaft a depth of 200 feet had been reached and the ore there was still continuous. In another place a depth of 75 feet was reached and the bottom was still good ore. There are a number of deposits of iron ore throughout the county of Pontiac. Some of them are evidently poor in quality and limited in extent. Others make a better showing, but only development work would prove whether they are of any value or not. On Calumet island, in the Ottawa river, both magnetite and hematite ores have been found, but no development work has been done and the quantity of ore is uncertain. An analysis of hematite ore showed it to be very low in both phosphorus and sulphur, but it contained a small percentage of titanic acid. There are large supplies of limestone within easy reach of the iron ore deposits along the Gatineau and the Ottawa rivers, and there are a number of waterfalls not far distant from which electric power could be obtained. It has been suggested that these ores might be smelted by electricity. In Grenville township of Argenteuil county, about halfway between the cities of Montreal and Ottawa, are iron deposits which have been talked of for years, but little development work has been done. There are a number of deposits of magnetite, but no large bodies of ore have been proven. Other iron ore deposits which have been favourably mentioned in Dominion Government geologieal reports, but which may be described as "not proven" are the St. Jerome mine, in Terrebonne; the Boniface mine, in Shawinigan; the Leeds mine, in Leeds, and the Sherbrooke mine, in Ascot.

It is estimated that there are many millions of tons of iron magnetite sands containing a high percentage of iron along the north shore of the St. Lawrenee at Moisie, Mingan, Natashkwan, and other places in the



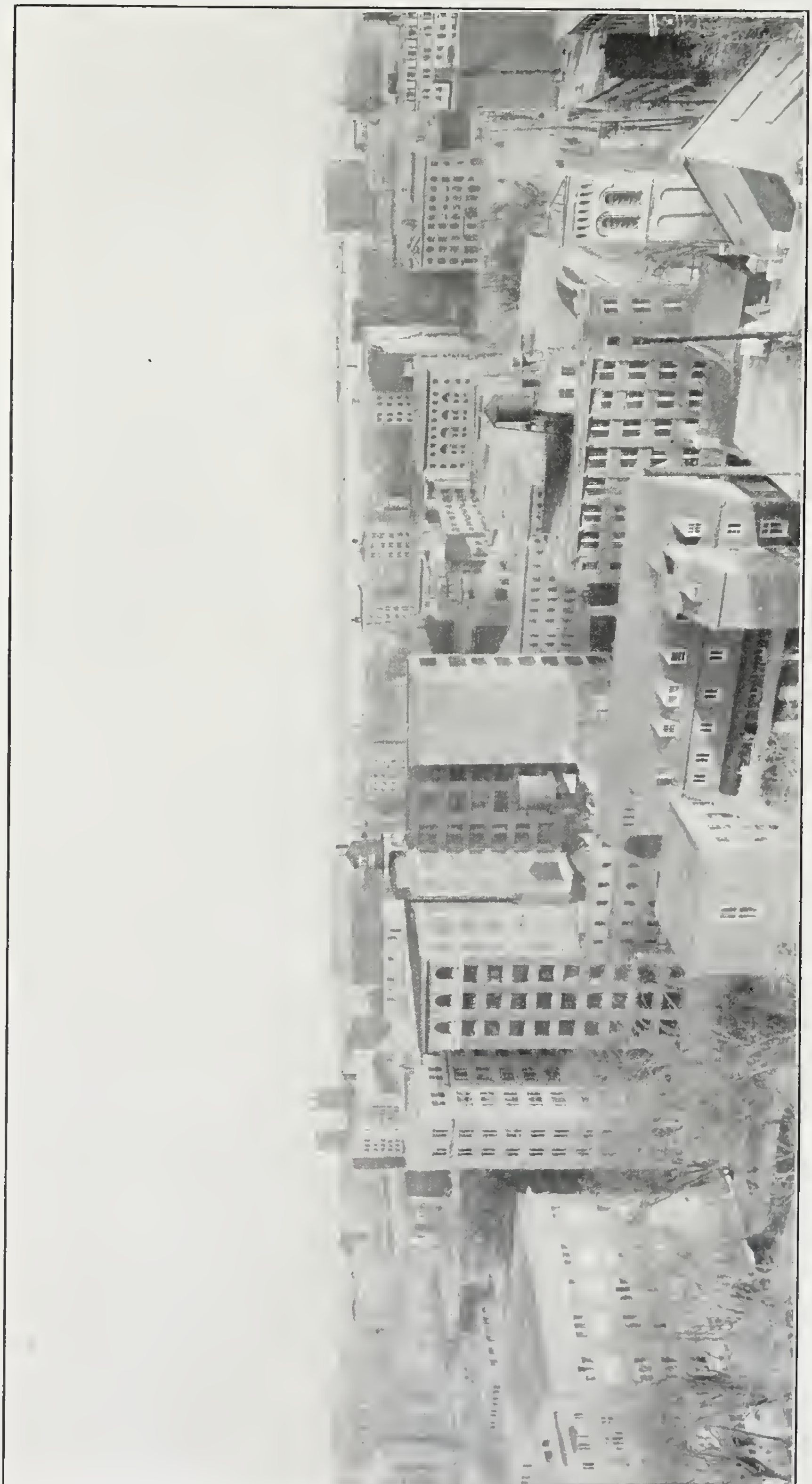
Montreal from Harbour Commissioners' elevator.

county of Saguenay. These sands could be briquetted easily for use in the blast furnaces, but unfortunately they contain a high percentage of titanium. Titanium, while not injurious to iron as sulphur and phosphorus are, causes trouble in the blast furnaces when present in quantity, and will not combine easily with either the iron or the slag. A very small percentage may be handled without much trouble and it improves the quality of the iron. Experiments under direction of the Dominion Mines Department have demonstrated that by means of the Swedish Gröndal magnetic separators and briquetting machines the sand can be freed almost entirely from its titanium content and made into briquettes suitable for use in the blast furnace, and that pig-iron of superior quality can be manufactured from these briquettes. There are a number of deposits of bog iron ore in the St. Lawrence valley remarkably free from sulphur and phosphorus and containing so small a percentage of titanium that it may be regarded as advantageous rather than injurious. Dr. Eugene Haanel, Director of the Dominion Department of Mines, says of these bog ores: "The origin of these deposits is interesting since they are being continually found at the present time, and it is possible to obtain ore which has been deposited during the last ten or twenty years. The rocks are highly ferruginous, and the iron is dissolved from them by the action of the rain-water containing organic acids resulting from decayed vegetation. The iron thus dissolved is transformed into salts of the protoxide. These mineralized waters stream down from the hills into the valleys and inland lakes, where the protoxide salts carried by the decomposed vegetation float on the surface of the water and are acted upon by the oxygen of the atmosphere, which converts the protoxide into the insoluble peroxide of iron. By a natural accretionary process, the iron oxides form into cakes of ore about seven inches in diameter; then they drop to the bottom of the lake. This evolutionary process is so rapid that some of the lake bed deposits which have been worked out are found after a rest of five years to have grown sufficiently to enable the owners to work them by dredges, mining for ten years continually on a commercial scale."

These bog iron ores have been successfully used in charcoal blast furnaces at Radnor Forges and Drummondville for many years.

Iron has never been made in Quebec province with coke as fuel. The province has many advantages for the manufacture of charcoal iron, but while a very superior iron can be made with charcoal the cost of manufacture is so much higher than when coke is used as fuel that it cannot be produced at a cost to compete with the coke-made product except when required for special purposes for which iron of superior quality is essential. If the melting of iron by electricity should ever become an economic success in competition with the blast furnace using coke as fuel Quebec province with its numerous water-powers generating electricity might become an important centre of iron manufacture.

There are believed to be important deposits of iron in Ungava, both on the mainland and along the coast and geologists think coal may also be found, but as the country is almost unexplored nothing definite can be stated about its mineral resources.



A bit of Montreal's down town business district.

ASBESTOS IN GREAT QUANTITY.

The asbestos deposits of the province of Quebec are the most important yet discovered anywhere, and they are said to supply eighty per cent of the world's consumption. The principal deposits so far discovered are at Thetford, Black Lake, Robertsonville, Dunville and East Broughton in the counties of Megantic and Richmond. Large mills are in operation preparing the asbestos for the market. The annual production is over 160,000 tons valued at about $3,850,000 according to the last report of the Mines Branch of the Dominion Department of Mines and includes a wide variety of grades from the long fibred crude asbestos valued at $399 per ton, down to the shortest mill fibre valued at only two or three dollars per ton and asbestic used for wall plaster and valued at from 75 cents to $1.50 per ton.

OTHER MINERALS IN QUEBEC.

In the Eastern Townships many small deposits of copper sulphides have been discovered and at some points they are found in considerable quantities. Mining operations have been conducted for many years. According to the last report of the Mines Branch the quantity of copper produced in 1913 was 3,455,887 pounds. In the vicinity of Sherbrooke there are three active mines. The sulphur content of the ore which runs over 40 per cent is utilized for the manufacture of sulphuric acid and the copper is then recovered from the residues by smelting. Small quantities of gold and silver are also recovered from these ores.

Alluvial gold in small quantities is found in the valley of the Chaudière and its tributaries, but the total output of gold including the amounts recovered, from the copper sulphide ores and the alluvial gold averages only about 700 ounces annually. Gold discoveries are reported to have been made recently in the vicinity of Lake Kiewawisik just north of the height of land and about 50 miles east of the Ontario boundary, but the value of the deposits is unknown. The silver production of the province was 34,573 ounces in 1913.

Tungsten is found in scheelite ores in Beauce county, but the deposits have not been developed.

On Calumet island in the Ottawa river zinc blende is found associated with galena. Small quantities of zinc ore have been exported, but mining has never been conducted on a large scale and the value of the deposits seems to be uncertain.

Chromite is found in the counties of Brome, Megantic, Richmond, Wolfe and Gaspé. The deposits in the township of Coleraine, Megantic county, have been worked intermittently. A small quantity of chromite has been successfully manufactured into chrome steel by electric smelting at Buckingham.

Deposits of feldspar believed to be extensive have been found in Ottawa county, and one of the deposits yields a remarkably pure white feldspar which is used in the manufacture of artificial teeth. Excepting the mining of small quantities for this purpose the feldspar deposits are at present entirely neglected.

Between the Gatineau river and the Rivière au Lievre, two tributaries of the Ottawa, there are extensive deposits of amber mica or phlogopite

Place d'Armes, Montreal.

Near Montreal's financial centre.

especially suitable for use as an insulator in electrical apparatus. There are also extensive deposits of this amber mica on the Ontario side of the Ottawa river, and the deposits in these two Canadian districts are so far as known the only amber mica found in economic quantities outside of Ceylon.

There are large quantities of graphite in the counties of Ottawa, Labelle and Argenteuil. The graphite occurs chiefly in the form of disseminated flakes which often form a high percentage of the rock. A number of mills have been operated in the district. Dr. R. W. Ellis of the Canadian Geological Survey who made a thorough investigation of these deposits and the method of treatment in the mills reported that it has been clearly established that the graphite of this district when treated in properly constructed mills is eminently suitable for all purposes to which graphite is usually applied with the exception of fine pencil making. This graphite is said to be particularly adapted for the manufacture of crucibles when properly treated.

Magnesite is mined in the township of Grenville, Argentueil county, and there are also deposits which are believed to be important in Brome county.

In the Magdalen islands there are manganese deposits which are supposed to be extensive.

There are many deposits of ochre in the counties to the north of the St. Lawrence river. Near the town of Three Rivers large quantities are dug and deposits in Nicolet county on the opposite side of the St. Lawrence are also being worked.

Twenty-five or thirty years ago large quantities of mineral phosphate or apatite were produced in the vicinity of Buckingham in the township of Ottawa. The deposits are extensive, but production has almost ceased because the cost of extraction was found to be too high to compete with the phosphates of Florida and Tennessee which can be cheaply mined with steam shovels.

Kaolin or china-clay of superior quality is obtained near St. Remi de Amherst, in Argenteuil county.

There are numerous deposits of limestone in Quebec province. The buildings in the cities and towns are largely constructed of limestone and it is used for a variety of purposes.

The cement plants near Montreal and at Hull use local limestone and clay materials.

NATURAL GAS IN QUEBEC PROVINCE.

Natural gas has been discovered in St. Hyacinthe county, about eight miles from the city of St. Hyacinthe and 35 miles from Montreal, and several wells have been drilled with promising results. There are indications of gas in many other parts of the St. Lawrence valley, but whether it exists in large quantities or not is as yet uncertain.

FISHERIES OF QUEBEC PROVINCE.

In its many rivers and lakes as well as along its extensive seacoasts, Quebec province has most valuable fisheries. Their importance is explained in Chapter XIII, on the fisheries of Canada.

St. James street, Montreal, taken after business hours.

McGill street, Montreal, taken after business hours.

The farms of Quebec province are generally long, narrow strips of land, frequently having a frontage on some river road with houses and outbuildings near the river banks, so that the farm houses stretch for miles along the rivers, looking almost like continuous villages and just as the rivers of the province here and there spread out into lakes, so these straggling farm villages at certain points expand and become towns with varied industries.

THE CITY OF MONTREAL.

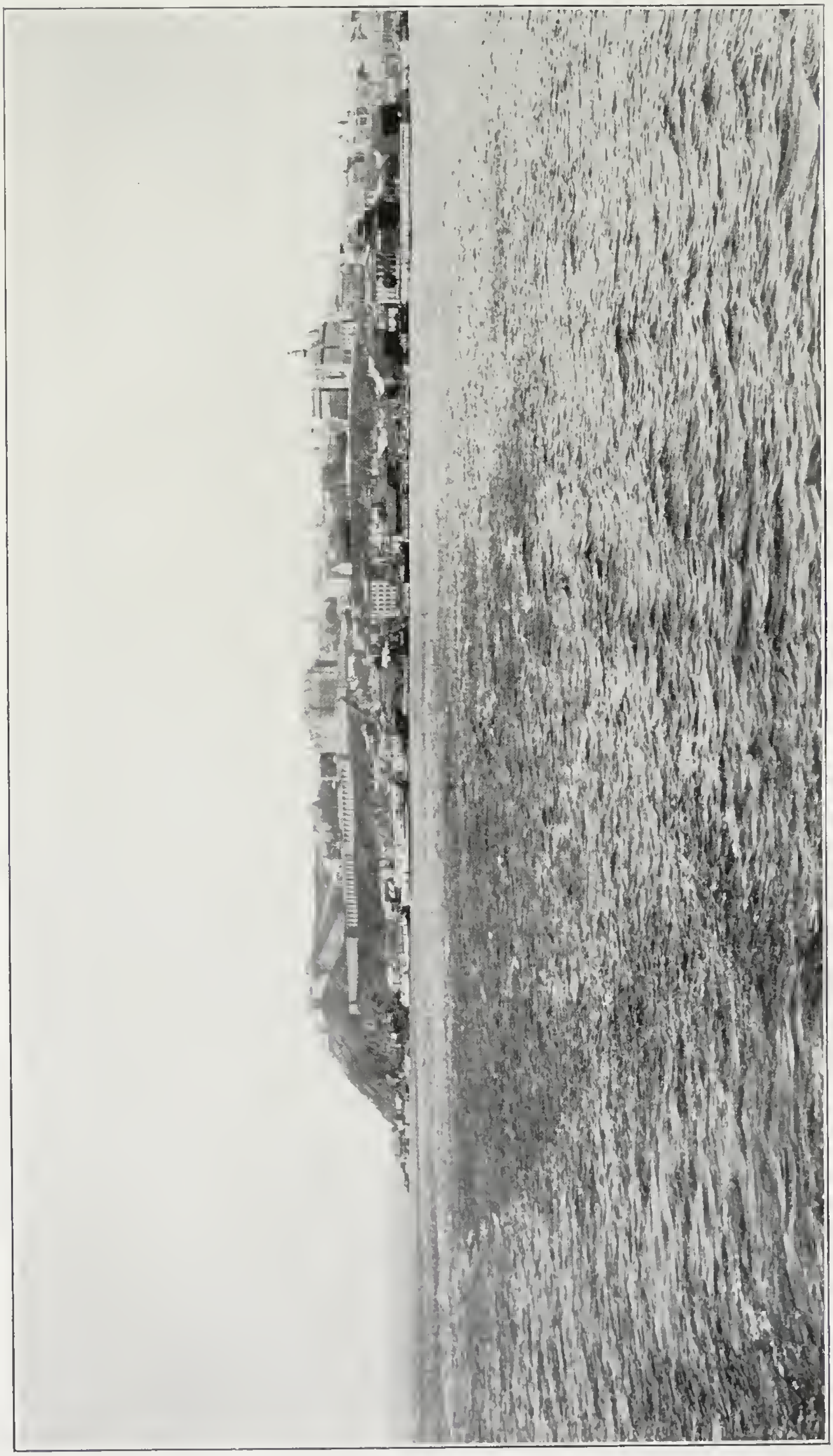
Montreal, the commercial metropolis of Canada, is located on an island 32 miles long and from four to eight miles wide, at the confluence of the St. Lawrence and Ottawa rivers. Although 1,003 statute miles from the ocean its harbour can be reached by large ocean vessels. Between lake St. Louis and the harbour of Montreal are the famous Lachine rapids, down which the mighty St. Lawrence river descends, but the Lachine canal connects the lake with the harbour, being the last of the series of canals which enable the vessels from the great lakes to avoid the rapids of the St. Lawrence and reach the harbour of Montreal, where they transfer their cargoes to the ocean vessels. Nearly in the centre of the island of Montreal rises a hill known as Mount Royal, and the old city of Montreal was built on a series of terraces between the river St. Lawrence and Mount Royal, the greater part of which was reserved for a public park, but now the city is rapidly spreading over the island.

Montreal is in latitude N. 45° 30′ 17″, slightly farther north than the city of St. John, N.B., and in about the same latitude as the city of Venice, which is in latitude 45° 25′ 58″ N.

In considering the fact that Montreal harbour is the meeting place for lake and ocean vessels, it must be remembered that the great lakes, of which the St. Lawrence is the outlet, lie between Canada and the United States, so that the states of the American Union which border on those lakes are to some extent tributary to Montreal.

Montreal is the headquarters of the Canadian Pacific, the Grand Trunk and the Grand Trunk Pacific Railways, and these railways in addition to their Canadian mileage own a large mileage in the United States, stretching out to Chicago and other important centres of the central and western states, making them tributary to the Canadian railway system, and although a large part of the American traffic carried by these railways is merely in transit between the western and eastern states it all adds to the importance of Montreal as a great railway and distributing centre. Here are located the most important car shops of the railway systems and thousands of skilled workmen are employed. While the headquarters of the Canadian Northern Railway are in Toronto, Montreal is its most important seaport.

The harbour of Montreal is under control of a Board of Harbour Commissioners appointed by the Dominion Government. Twenty-five million dollars have already been expended in providing the most modern harbour facilities, and in 1914 the Dominion Parliament voted as a loan an additional sum of nine million dollars for this purpose. The trade of the port is growing so rapidly that it will be necessary to annually



Quebec City from Levis.

increase the accommodation. Including the accommodation for ocean vessels and lake and river vessels the total berthing space is now about 7½ miles.

Montreal is the greatest grain port of America, the quantities of grain handled at the leading ports being as follows during the season of 1914:—

	Bushels.
Montreal	75,085,432
New York	64,582,190
Baltimore	45,000,000
Galveston	35,821,506
New Orleans	34,624,000
Philadelphia	23,294,252
Boston	16,555,340
Portland	9,500,000
St. John, N.B.	6,269,000
Newport News	2,326,620

During the season of 1914 the number of vessels arriving at the port of Montreal was 13,141, with a tonnage of 9,044,457 tons. The number of vessels arriving at the great British port of Liverpool in 1914 was 25,000, with a tonnage of 19,000,000 tons. Thus the number of vessels arriving in Liverpool during a period of twelve months was less than twice as great as the number arriving in Montreal in a period of seven months' navigation, while the tonnage was a little more than twice as great. The growth of Montreal's shipping in recent years is remarkable. In 1905 the tonnage was only 4,725,607 tons, as compared with 9,044,457 tons in 1914. The inland vessels arriving at Montreal numbered 12,225, with a tonnage of 6,288,939 tons; the vessels from the Maritime Provinces numbered 365, with a tonnage of 716,385 tons.

Montreal is a great industrial centre. Its central situation, its shipping facilities by rail and water and its cheap electric power, as well as its facilities for conveniently bringing in coal both from the Maritime Provinces and the United States, offer great advantages to manufacturers.

According to the Dominion census of 1911 the population of Montreal was 470,480, but its growth since then has been very rapid and according to the estimate of the city clerk, based on the city directory it was 617,000 in 1914. Outside the city limits are several populous suburban towns which if annexed to the city of Montreal would increase its population figures to about 717,000.

THE CITY OF QUEBEC.

Quebec city, the capital of the province, in its historical and picturesque aspects is probably better known to the world at large than any other town in Canada. Its quaint, old-fashioned streets, its famous citadel, the magnificent promenade of the Dufferin Terrace, and the grandeur of the surrounding scenery have so often been described by tourists that everyone is familiar with them. But Quebec city is not so old as it looks. It is true that a good sized town was there when the rest of Canada was a wilderness and some of the old houses stand to-day, but a new city fashioned after the old models has grown up around them. In recent years the population has increased quite rapidly, while in tanning, shoe-making and several other lines of manufacture the growth has been quite remarkable. The beautiful Montmorency falls near the city are now being utilized to gen-

crate power for manufacturing purposes. With the completion of the St. Lawrence river bridge and the operation of the National Transcontinental railway Quebec city's railway communication with the Maritime Provinces, the Prairie Provinces and British Columbia will be greatly improved. Quebec has a fine harbour and the terminal and elevator facilities are adequate for a considerably larger shipping business than the port at present enjoys. As Canada grows in population and commercial importance it may be expected that Quebec city will get its share of the shipping trade. It has always been an important centre of the timber industry. The extension of the season of navigation at Quebec would be less difficult than at Montreal and it is probable that navigation could be maintained for nearly nine months of the year. The population according to the Dominion census of 1911 was 78,710. In 1915 the city assessors estimated it at 100,000.

SMALL CITIES OF QUEBEC PROVINCE.

At the census of 1911 Hull, a thriving lumbering and manufacturing city on the Quebec side of the river directly opposite the capital city of Ottawa, had a population of 18,222; Sherbrooke, the central market town of the Eastern Townships with a number of manufacturing industries supplied with electric power from the St. Francis river, had 16,405; Three Rivers, a thriving manufacturing and shipping centre at the confluence of the St. Maurice river and the St. Lawrence river, 70¾ miles below Montreal and 21 miles from the great Shawinigan electric power plant, had 13,691; Valleyfield, on the upper St. Lawrence, noted for its cotton mills had 9,449; St. Hyacinthe, a manufacturing town on the Yamaska river in the Eastern Townships, had 7,797; Sorel, at the mouth of the Richelieu river, with a Dominion Government shipyard and three other shipyards chiefly used for repairing river vessels, had 8,420; Lévis, opposite Quebec cit,y 7,452; Thetford Mines, 7,201; Joliette, 6,345; St. Johns, 5,903, and Chicoutimi, 5,880. Some of the suburban cities around Montreal are larger than any of the towns mentioned, but they are merely outgrowths of the metropolis.

Outer basin, Quebec Harbour.

Chapter VII.

THE GREAT LAKES AND CANALS.

One of the most notable features of Canada is its system of river reservoirs in the form of lakes and this is strikingly exemplified in the great lakes which form the southern boundary of the province of Ontario, and have their outlet in the St. Lawrence river. The St. Lawrence proper may be said to begin at Montreal, the head of navigation for ocean vessels, but the great river has its source somewhere in the wilderness of northern Ontario, and its first big reservoir is Nepigon, a large lake of pure blue water, the outlet of which is Nepigon river flowing into the second reservoir, lake Superior. Without including lake Michigan, which lies wholly within the United States, there are seven such reservoirs between lake Nepigon and Montreal, viz.: Lake Superior, lake Huron including Georgian bay, lake St. Clair, lake Erie, lake Ontario, lake St. Francis and lake St. Louis, the first five lying between Canada and the United States, while the other two are wholly in Canada.

The great lakes between Canada and the United States, which form the principal reservoirs of the St. Lawrence river, are famous the world over. Lake Superior has an extreme length of 400 miles, an extreme width of 160 miles, an area of about 31,400 square miles and a maximum depth of 1,200 feet. Lake Huron has an extreme length of 280 miles, an extreme width of 105 miles, an area of 23,800 square miles, and a maximum depth of 1,800 feet. Lake Erie has an extreme length of 240 miles, an extreme width of 58 miles, an area of 9,600 square miles and a maximum depth of 270 feet, while lake Ontario's greatest length is 190 miles, its greatest width 55 miles, its area 7,300 square miles and its maximum depth 500 feet.

At Sault Ste. Marie the level of lake Superior is 591 feet above the St. Lawrence at Montreal, and the water reaches the lower level by one great fall on the Niagara river between lakes Erie and Ontario and a series of rapids at different points which necessitated the construction of a number of canals.

A GREAT INTERIOR WATERWAY.

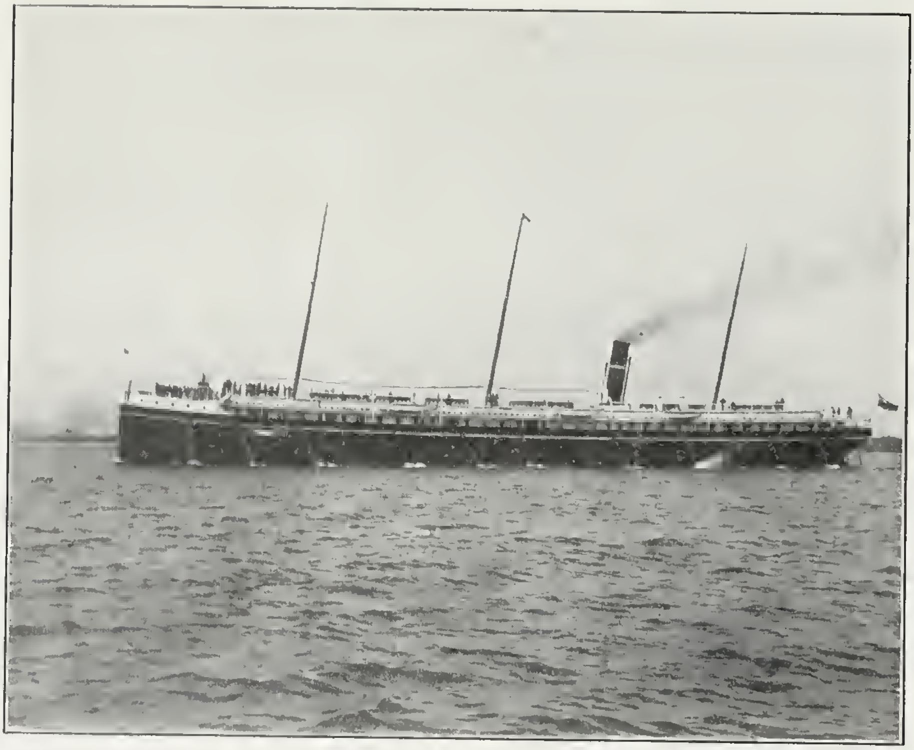
The St. Lawrence system including the gulf, lakes, river stretches and canals, provides a continuous navigable inland waterway extending from the strait of Belle Isle to Duluth, a distance of 2,339 statute miles from the Atlantic ocean. The distance to Port Arthur on Thunder bay at the head of navigation on the Canadian side of the lake is 2,217 statute miles, while the distance to Chicago is 2,243 statute miles. In this great waterway there are 74 miles of canals with 49 locks. From Montreal to Fort William at the head of Canadian lake navigation the distance is 1,214 statute miles, the distance to Chicago, 1,240 statute miles, and the distance to Duluth 1,336 statute miles.

Steamship Assiniboia (3,880 tons) passing through Sault Ste. Marie Canal.

Whaleback boats passing through the Sault Ste. Marie Canal. Some of the freight boats passing through this canal have a registered tonnage of 6,000 tons.

The Sault Ste. Marie rapids, on the St. Mary's river, between lakes Superior and Huron, are avoided by a canal 7,067 feet in length, between the extreme ends of the entrance piers. There is one lock 900 feet by 60 feet, the depth of water at lowest known level being 18 feet but ordinarily about 20 feet. There is a similar canal on the United States side of the boundary, built by the United States Government, and these waterways are popularly known as the "Soo" canals. Some of the freight boats passing through these canals are 602 feet long and 60 feet beam, with a registered tonnage of 6,000 tons net. A large percentage of the freight passing through is carried by boats of over 4,000 tons net register. As the Canadian and American Sault canals are side by side, and free to vessels of both nations, Canadian vessels sometimes use the American canal and American vessels the Canadian canal, selecting whichever is the more convenient for passage at the moment of arrival. In 1913, 15,599 vessels, having registered tonnages of 32,062,619 tons and freight tonnages of 37,022,201 tons, passed through the American canal, and 8,285 vessels, having registered tonnages of 25,974,441 tons and freight tonnages amounting to 42,699,324 tons, passed through the Canadian canal. During the same year 5,085 vessels, with tonnages amounting to 20,033,884 tons, passed through the Suez canal.

From the St. Mary's river there is deep-water navigation through lake Huron, the St. Clair river, lake St. Clair, the Detroit river and lake Erie. The Niagara falls are avoided by means of the Welland canal from Port Colborne on lake Erie to Port Dalhousie on lake Ontario, $26\frac{3}{4}$ miles in length, with twenty-six locks. From Port Dalhousie to the foot of lake Ontario there is deep-water navigation, but on the St. Lawrence between lake Ontario and Montreal six canals, with an aggregate length of $46\frac{5}{12}$ miles, and twenty-two locks are necessary to avoid rapids. These canals are the Galops, $7\frac{3}{4}$ miles long with three locks; the Rapide Plat, $3\frac{2}{3}$ miles long with two locks; the Farran's Point, $1\frac{1}{2}$ mile long with one lock; the Cornwall, 11 miles long with one lock; the Soulanges, 14 miles long with five locks, and the Lachine canal, $8\frac{1}{2}$ miles long with five locks, connecting lake St. Louis with the harbour of Montreal. The minimum dimensions of the canal locks between lake Erie and Montreal are: length, 270 feet, width, 45 feet, depth of water on sills, 14 feet. Vessels 255 feet long can be accommodated. It will be noted that the dimensions of the canals between lake Erie and Montreal are less than those of the Sault Ste. Marie canal. The large lake vessels coming down from the upper lakes transfer their cargoes to the smaller vessels at Port Colborne. However, a larger canal is now being constructed between lake Erie and lake Ontario. According to the statement of the engineer in charge, this enlarged canal will follow the course of the present canal from Port Colborne on lake Erie to Allanburg, half-way across the peninsula, from which point a new cutting will be made to a point on lake Ontario to be known as Port Weller, three miles from the Ontario entrance to the present canal. The total length of the canal from lake to lake will be 25 miles, and the difference in level between the two lakes, $325\frac{1}{2}$ feet, is to be overcome by seven lift locks, each having a lift of $46\frac{1}{2}$ feet. The dimensions of the locks are to be 800 feet in length by 80 feet in width in the clear, with 30 feet of water over the mitre sills at extreme low



A typical ship of the inland lakes, 3,856 tons.

Shipping fruit at Sarnia, River St. Clair.

water in the lakes. The width of the canal at the bottom will be 200 feet. For the present the canal reaches will be excavated to a depth of 25 feet only, but all structures will be sunk to the 30-foot depth, so that the canal can be deepened at any future date by the simple process of dredging at the reaches. This canal will have greater dimensions than any other Canadian canal. When it is completed the largest lake vessels will be able to go from the head of lake Superior to Kingston, near the foot of lake Ontario, where they will have to transfer their cargoes to smaller vessels running through the St. Lawrence canals to Montreal until the St. Lawrence canals are enlarged, as they probably will be eventually.

From lake Ontario to a point a little below Cornwall the St. Lawrence flows between Canada and the United States, but from that point to the sea the great river is entirely in Canada.

OTTAWA RIVER CANALS.

The chief tributary of the St. Lawrence is the Ottawa, a great river about 750 miles long, which rising in the province of Quebec flows westward in an irregular course, with numerous rapids and several lake expansions before reaching lake Timiskaming, out of which it flows southward, and running down between the provinces of Ontario and Quebec joins the St. Lawrence at the island of Montreal, at the head of which it expands into the lake of Two Mountains and then divides into three branches, one uniting with the St. Lawrence to form lake St. Louis, while the other two encircle isle Jesus, at the back of Montreal island, and then uniting enter the St. Lawrence at the foot of Montreal island. The Ottawa river below lake Timiskaming has an ordinary width of about half a mile, but often widens to nearly a mile, and has a number of lake expansions where it becomes of still greater width, while it occasionally contracts to a width of a quarter of a mile. Many stretches of the river are so deep that great ocean vessels could float easily, but in some places the river would require dredging to make it accommodate even the vessels that navigate the great lakes, while canals and dams are required at certain points on account of the rapids and shallow places. The volume of water is always great enough to accommodate large vessels provided it is directed into suitable channels. Between Ottawa and Montreal there are the St. Anne's locks and the Carillon and Grenville canals, which are, respectively, ⅛ of a mile, ¾ of a mile and 5¾ miles in length. There is a depth of nine feet of water on the sills of the locks of these canals. The Carillon dam, which is 2,400 feet in length and 12 feet high, was built across the river to increase the depth of water in the Carillon canal. It has been found to raise the water in the river two feet at a point six miles above it.

PROPOSED OTTAWA AND GEORGIAN BAY CANAL.

For many years the construction of a canal to connect the Ottawa river with Georgian bay has been talked of. The head of Georgian bay is less than 123 miles from the Ottawa river. Between them stretch the French and Pickerel rivers, lake Nipissing, Trout lake, lake Talon, and the Mattawa river, the watershed between the waters flowing into Georgian bay and those flowing into the Ottawa river being only about 3½ miles

across. Some years ago Government engineers made a survey of the route and reported that a waterway with a depth of 22 feet at lowest water could be provided from Georgian bay to Montreal at a cost of about one hundred million dollars. The distance from Georgian bay to Montreal harbour by the route surveyed would be 440 miles, while from Fort William to Montreal the distance would be 934 miles, as compared with 1,217 miles by the great lakes and St. Lawrence river route. From Montreal to Sault Ste. Marie the distance would be 661 statute miles, as compared with 600 miles from Buffalo to Sault Ste. Marie. Thus ocean vessels at Montreal would be almost as near to the west as the Erie canal boats at Buffalo are. Montreal and Chicago would be brought within 972 miles of each other, as compared with 1,242 miles by the present route. Of the 440 miles of projected navigation it is estimated that only 38 miles would be entirely artificial, but many stretches of lake and river navigation would have to be improved. Only 27 locks would be required. The locks would be 650 feet long and 65 feet wide, with a depth of 22 feet of water on the sills, so that the system would accommodate vessels of somewhat greater size than the largest now passing through the Sault canals. The length of navigation in the shortest season would be 211 days. At the island of Montreal one plan provides for a route through lake St. Louis and a canal paralleling the Lachine. Another plan takes the waterway down the river course at the back of the island of Montreal and makes connection with the St. Lawrence about 17 miles below the harbour of Montreal.

WATERWAY FROM MONTREAL TO NEW YORK.

The greater part of lake Champlain is in the United States, but its natural outlet is the Richelieu river which joins the St. Lawrence 46 statute miles below Montreal. The other end of lake Champlain is connected by the Champlain canal with the Erie canal at a point seven miles above where the Erie joins the Hudson river at Albany. A vessel drawing 6½ feet of water can go from Montreal to New York by this route, taking the St. Lawrence to Sorel, passing along the Richelieu to St. Ours lock, through St. Ours the Richelieu river, Chambly Basin and the Chambly canal to lake Champlain and thence by way of the Champlain canal, the Erie canal and the Hudson river, a distance of 457 miles from Montreal to New York as compared with 533 miles from Buffalo to New York by the Erie canal. Throughout the greater part of lake Champlain the depth of water is over 100 feet and in some places is 400 feet deep. The state of New York is now enlarging the Champlain canal to a depth of 12 feet and one section has already been completed. It has been suggested that Canada should construct a canal of the same capacity from Longueuil opposite the city of Montreal to the Chambly canal and enlarge the Chambly canal to 12 feet, greatly shortening the water distance from Montreal to New York. A survey for such a canal was made a number of years ago, and it was claimed that it would be easy of construction. Another canal route surveyed about the same time was from Caughnawaga on lake St. Louis to the Chambly canal, and it was stated that the distance from Montreal to New York by this route would be 394 miles. Cargoes could be transhipped from lake vessels to Champlain canal boats at Montreal just as they are transhipped from lake

vessels to Erie canal boats at Buffalo. Of course anything intended for shipment across the Atlantic would be transferred to ocean vessels at Montreal, but a great deal of the tonnage that passes through the Erie canal is interstate traffic and the proportion of western food products required for consumption in New York and neighbouring cities is steadily increasing. It is claimed that a St. Lawrence and Champlain canal system in connection with the Ottawa and Georgian bay waterway would furnish a much shorter route for such interstate traffic than the route by way of Buffalo and the Erie canal.

THE RIDEAU CANAL SYSTEM.

On a summit of land between the Ottawa river and the lower end of lake Ontario is a series of small lakes, some of which discharge their waters into the Rideau river emptying into the Ottawa river at Ottawa city, while the others empty into lake Ontario at Kingston through the river Cataraqui. By connecting and improving these two river systems continuous navigation for boats drawing five feet of water has been established between Ottawa city and Kingston, a distance of 126¼ miles. On one occasion when there was a break down on the Cornwall canal temporarily stopping navigation, the blockade was partially relieved by loading grain and other produce into small barges and sending them to Montreal by way of the Rideau canal and the Ottawa river. The distance between Montreal harbour and Kingston on lake Ontario by this route is 245⅝ miles, while by the St. Lawrence route the distance is only 178 miles.

THE TRENT VALLEY CANAL.

Another scheme to avoid the navigation of lakes Huron, Erie and Ontario, and shorten the distance between Montreal and Georgian bay is known as the Trent Valley canal, in making which it is proposed to utilize the series of bays, rivers and small lakes which stretch across Ontario almost continuously from the Thousand Islands to lake Huron, beginning with Quinte bay, which extends from near Kingston to Trenton at the mouth of the Trent river, and ending with the Severn river which flows out of lake Simcoe into Georgian bay. To connect the waters which drain into Quinte bay with those draining into lake Simcoe only 13¾ miles of canal would have to be cut, but several other short canals are necessary to secure a navigable waterway. Eleven small lakes and four rivers are embraced in this scheme of navigation. The distance between Quinte bay and Georgian bay by this route would be about 235 miles. A large amount of money has already been expended in improving navigation on this Trent system of rivers and no doubt there will ultimately be navigation between the bay of Quinte and Georgian bay for boats drawing six feet of water, but the route will never be of more than local importance. The western end of Quinte bay has been connected with lake Ontario by cutting through Murray Isthmus a canal without locks 5⅛ miles in length, 80 feet wide and 11 feet deep at lowest water.

FROM LAKE SUPERIOR TO LAKE WINNIPEG.

The Kaministiquia river, which flows out of Dog lake into Thunder bay and its tributary the Mattawin, which comes from lake Shebandowan,

are both navigable, but on the Kaministiquia, about fifteen miles above Fort William, occurs the wonderful Kakabeka waterfall. This waterfall could be avoided by a short canal and then there would be continuous navigation between Port Arthur and lake Shebandowan which is 45 miles distant by the Dawson road, a public highway. Lake Shebandowan is 18 miles long, and a portage of three quarters of a mile connects it with Lake Kashebowie, nine miles long. Another portage of one mile takes a boat over the height of land to Lac des Milles Lacs, which is 18½ miles long. From this lake to Rainy lake there is a continuous chain of lakes and rivers, but navigation is interrupted at certain points necessitating portages aggregating six and a half miles in length, the total distance between the lakes being 119 miles, including portages. From the head of Rainy lake to the northwest angle of the lake of the Woods, a distance of 164 miles, there is uninterrupted navigation for large vesels, except at Fort Francis near the outlet of Rainy lake, where a canal 800 feet long to overcome the Kettle Falls was cut through the solid rock some years ago, but the construction of the lock gates was deferred and the work has never been completed. The Winnipeg river connects the lake of the Woods with lake Winnipeg, but navigation is obstructed by rapids and waterfalls. A system of canals connecting the natural waterways along this route and surmounting rapids would give a continuous navigable waterway from lake Superior to lake Winipeg, and the western rivers which flow into it. Barges might be loaded all along the Saskatchewan and Red rivers, transferring their cargoes to lake vessels at Fort William. There is no likelihood of the construction of such a canal system in the near future, but when Canada has twice its present population it may be undertaken.

RIVERS FLOWING INTO JAMES BAY.

Lac des Quinze, one of the lake expansions of the Upper Ottawa river is not far from the height of land on the other side of which lies lake Abitibi. Between Lac des Quinze and Abitibi stretch several small lakes and rivers, having a total length of about 66 miles, and the watershed between the two systems is only one mile wide. The Abitibi river carries the outflow of lake Abitibi down to James bay at Moose Factory, meeting there the Moose river which has two branches, the Matagami, flowing out of lake Kanogamissie, and the Missinibe flowing out of lake Missinibie. Lake St. Joseph's outlet, the Albany river, empties into the bay at Fort Albany in latitude N. 52° 8′. The Albany river has several tributaries with numerous lake reservoirs and these approach so close to both Long lake and lake Nepigon that it would not be difficult to make connection with lake Superior, but no canal projects will be undertaken in this northern part of Ontario until Canada's population is vastly greater than it is to-day. Besides these Ontario rivers James bay also receives from the west the Attahpiskat river, and from the Quebec side the East Main river and the Rupert river, lake Mistassini's outlet.

James bay is about 300 miles long and is so shallow that excepting a channel down its centre the muddy bottom may be touched with an oar by a person rowing in a small boat when almost out of sight of land, while it is almost free from saline matter owing to the volume of fresh water poured into the bay from the great rivers that empty into it.

The deeper channel runs northward like a river from near Moose Factory to Mansfield island in Hudson bay. Directly south of James bay is a low, level, swampy basin, bounded by distinct veins of hard rocks, the rim being high with a steep slope towards the centre, and the thought is suggested that this basin once contained a lake which was the reservoir of a number of rivers rising on the northern slope of Ontario's height of land, while what is now James bay was a long valley through the centre of which flowed a great river carrrying the waters of the lake to Hudson bay and receiving on its way several large tributaries. Such a lake bursting from its bounds and spreading over the valley to the north of it would form the shallow, muddy James bay.

Grand Trunk Railway car ferry crossing Lake Ontario from Cobourg to Rochester.

Toronto harbour, near the centre.

Chapter VIII.

THE PROVINCE OF ONTARIO.

The province of Ontario is the section of the Dominion lying between the great international lakes and Hudson bay. It extends from the western boundary of Quebec to the eastern boundary of Manitoba, and has an area of 365,888 square miles of land and 41,382 square miles of water, a total of 407,262 square miles. A territory as large as the American states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Pennsylvania, West Virginia, Ohio, Indiana and Michigan might be cut out of its land area and there would be still some thousands of miles to spare. It is nearly as large as Germany and France combined.

The shape of Ontario is somewhat similar to that of Italy, with the foot of the boot in the great lakes, just as the Italian boot extends into the Mediterranean, but instead of the Adriatic sea, Ontario has the Ottawa river on its eastern boundary.

The southern part of the province is in nearly the same latitude as Italy, Pelee island in lake Erie being almost as far south as Rome, while Toronto, the capital of the province, in latitude N. 43° 37′ 46″, is farther south than Florence, which is in latitude N. 43° 46′ 41″, and the city of Hamilton, in latitude N. 43° 18′ 20″, is in about the same latitude as the French port of Marseilles, in latitude N. 43° 17′ 50″. Moose Factory, the Hudson's Bay Company post on James bay, at the confluence of the Moose and Abitibi rivers, is in latitude N. 51° 16′, a little farther south than London, England, the world's metropolis being in latitude 51° 29′.

Through the province from lake Abitibi to lake St. Joseph runs the elevated belt known as the height of land, from 1,000 to 1,500 feet above sea-level, an extension of the highland belt of Quebec province. On the southern slope of the height of land are the sources of the rivers which empty into the great lakes and the St. Lawrence river, while those flowing into Hudson bay rise on its northern slope.

THE CLIMATE OF ONTARIO.

The climate of Ontario varies considerably according to latitude, elevation and the character of the surrounding waters. That part of the province which is almost surrounded by lakes Ontario, Erie, Huron and Georgian bay has a more moderate climate than the part of the United States immediately to the south. According to the records of the Dominion Meteorological Service for a period of seven years, in Hamilton at the head of lake Ontario the average of all temperatures for seven years was in January and February, 21·7°; March, 28·8°; April, 42·3°; May, 55·1°; June, 64·1°; July and August, 69·8°; September, 62·6°; October, 50·2°; November, 38·5°; December, 28·8°. The average of

maximum temperatures for seven years was in April, 78°; May, 83·6°; June, 88·4°; July and August, 94·5°; September, 88·4°; October, 77·7°; November, 67·2°. The minimum temperatures averaged in January and February, -11·8°; March, -2·3°; April, 16·8°; May, 29·1°; June, 37·8°; July and August, 39·5°; September, 32·5°; October, 20·9°; November, 10°; December, -1·1°.

Owing to the altitude the coldest part of the province of Ontario is along the height of land. As the country slopes northward from the height of land to James bay the difference in latitude is more than offset by the lower elevation. It is believed also that the many small lakes between the height of land and James bay tend to moderate the climate.

At Moose Factory on the south shore of James bay during a period of seven years the average of all temperatures for seven years was in January and February -0·8°; March 11·8°; April 25·2°; May 43·9°; June 52·4°; July and August 60·9°; September 51°; October 39·1°; November 21·3°; December 9·9°. The average of maximum temperatures for seven years was in April 54·4°; May 75·7°; June 84·9°; July and August 88·6°; September 74·7°; October 72·8°; November 46·7°. The minimum temperatures for seven years averaged in January and February -38·5°; March -26·5°; April -8°; May 16·9°; June 28·6°; July and August 36·4°; September 30·9°; October 13·1°; November -8·9°; December -25·1°. The greatest degree of cold experienced in an average winter at Windsor, near the southwestern corner of the province is -10°; Toronto -16·1°; Ottawa -26·9°; Owen Sound -28°; Port Arthur -35·6°. The average of all temperatures during the months of January and February for seven years was 22·5° at Windsor; 19·6° at Toronto; 9·8° at Ottawa; 18·2° at Owen Sound; 2·8° at Port Arthur. It will be noted that the temperature at Moose Factory on the southern shore of James bay during the coldest winter months is not three degrees lower than that of Port Arthur on lake Superior. During the spring and early summer Port Arthur's temperature is five or six degrees higher, while in July, August, September and October the temperature of the two points is almost precisely the same. Because Hudson strait is blocked with ice in summer it is commonly supposed that any district bordering on Hudson bay must be practically without summers, but when it is remembered that Hudson bay including James bay is over 800 miles long, while Hudson strait is about 500 miles long, it can be imagined that the ice in the far north does not greatly affect the climate of the south shore of James bay. The southern end of James bay is as far from Hudson strait as the north shore of lake Ontario is from the gulf of Mexico.

The thermometer never registers quite as low in winter at Moose Factory as it does in the well settled American States of Minnesota, Dakota and Montana. The summer temperatures from the beginning of May until the end of September correspond very closely with those of Edinburgh, Scotland, as shown by the record of fifteen years.

SOUTHERN ONTARIO.

The population of Ontario was 2,523,274 according to the census of 1911 and about 94 per cent of the people are concentrated within the peninsula bounded by the French river, lake Nipissing and the chain of small lakes and rivers extending toward the Ottawa, the Ottawa river, the St.

Lawrence, lake Ontario, lake Erie, the Detroit river, lake St. Clair, river St. Clair, lake Huron and Georgian bay, a district having an area of 51,150 square miles without including the surrounding waters, about the same sizo as England, which has an area of 50,200 square miles. This district is sometimes called Old Ontario, sometimes Southern Ontario, while the remainder of the province is known as New Ontario or Northern Ontario.

Nearly the whole of Old Ontario is fertile, although in some of the south eastern counties as well as in the counties of Muskoka, Parry Sound and Nipissing there are considerable areas more suitable for forest reservations than for farm lands. Muskoka has a chain of very pretty lakes which attract many tourists in summer. In Parry Sound the Ontario Government has set aside a district known as Algonquin Park as a forest and game reservation.

THE FRUIT GARDEN OF ONTARIO.

Apples and certain varieties of grapes can be grown successfully in any part of Old Ontario, but the fruit garden of the province is the southwestern peninsula, lying between lake Erie and Georgian bay, and bounded on the west by the Detroit river, lake St. Clair, river St. Clair, and lake Huron. This district rivals the Annapolis Valley of Nova Scotia in the production of apples, while peaches, pears, plums and the finest varieties of grapes grow to perfection in the southern counties. Peaches and grapes aro most extensively grown in the district between Hamilton and Niagara where there are many thousands of acres of peach orchards. The fruit growing areas are continually extending in the southern counties of Ontario, lands formerly devoted to grain growing and general farming being planted with orchards. Ontario farmers at one time devoted their lands almost entirely to grain growing and large quantities of wheat, oats, and barley are still produced, but grain growing has to a large extent given place to fruit growing and dairy farming. Ontario leads the world in the production of cheese. During the fourteen years ending with 1914 the average annual production of cheese was 136,047,890 pounds.

THE DISTRICT OF ALGOMA.

The country stretching from lake Nipissing to the lake of the Woods and extending from the northern shores of Georgian bay, lake Huron and lake Superior to the height of land is known as the Algoma district, and has often been described by superficial observers as a worthless rocky region, which must always prove an insurmountable barrier between central Canada and the Northwest. That it looks rocky and worthless, whether viewed from a steamship or from a railway car, cannot be denied, but throughout this region are numerous little fertile valleys, sheltered from the rough winds by the much abused rocky hills and watered by swift flowing rivers and pretty lakes. It must be admitted that these valleys being small there is not much good land in any one spot, but altogether there are probably millions of acres available for cultivation between Nipissing and Port Arthur, but the greater part of this area will never be anything more than a lumbering, and mining region. The fact that most of the rivers of the province have their sources on the slopes of the height of land make it desirable that it should be maintained as a forest reservation and if the

A fruit farm at Grimsby, Southern Ontario.

forests are properly protected they may be made to yield a large revenue to the province. In the vicinity of Port Arthur and along the Rainy river and about the lake of the Woods there are large tracts of fertile land.

WEALTH IN THE ROCKS.

But the wealth of the Algoma district is in the rocks rather than in the soil, for there is reason to believe that it is one of the richest mineral districts of the world. Great discoveries of nickel, copper, silver and gold have already been made, and only a small part of the district has been thoroughly prospected.

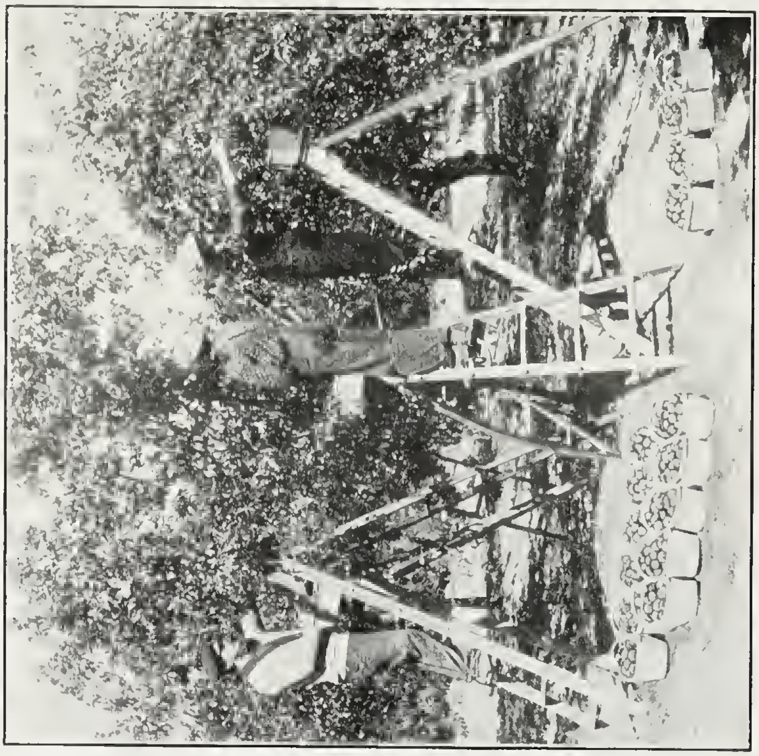
THE NORTHERN WILDERNESS OF ONTARIO.

The country north of the height of land is almost a complete wilderness. The Grand Trunk Pacific railway and the Canadian Northern railway have recently been constructed through it, but the settlement of the country has hardly begun. The Ontario Government has built a railway from North Bay, at the head of lake Nipissing, to Cochrane, on the Grand Trunk Pacific, and settlement is extending along this railway.

Exploring parties sent out by the Ontario Government have made favourable reports. A summary of these reports issued by the Provincial Government says: "The results of these extensive explorations as detailed in the elaborate reports sent in by the surveyors, the land and timber estimators and the geologists have fully justified the most sanguine expectations in regard to the natural wealth and fertility of Northern Ontario. It has been established beyond controversy that in the eastern part of the territory north of the height of land there is an immense area of excellent agricultural land, apparently equal in fertility to any in older Ontario with an equable and temperate climate and an abundance of wood and water. The great clay belt comprises an area of at least 24,500 square miles, or 15,680,000 acres. This almost unbroken stretch of good farming land is nearly three-quarters as great in extent as the whole settled portion of the province south of Georgian bay, lake Nipissing and the French and Mattawa rivers. The region is watered by the Moose river, flowing into James bay, and its tributaries the Abitibi, Mattagami, and Missinibe, and by the Albany and its tributaries, the Menogami and Ogoke. Each of these rivers is over 300 miles in length and they range in width from 300 or 400 yards to a mile. They are fed by numerous smaller streams and these in turn drain numberless lakes of larger or smaller size, so that the whole country is one network of waterways with long stretches fit for navigation. The great area of water surface also assures the country against the protracted droughts so often experienced in some countries."

NO COAL IN OLD ONTARIO.

Geologists say that coal will never be found in old Ontario, but it is possible that coal may be discovered in the northern part of the province. There are extensive peat beds both in Old Ontario and New Ontario. At present Ontario is almost entirely dependent on the United States for coal, as Nova Scotia coal goes no farther west than Cornwall. Some of the mine operators of Nova Scotia believe that if the Ottawa and Geor-



Picking peaches in Southern Ontario.

A Vineyard in Southern Ontario.

gian Bay canal were constructed and the St. Lawrence canals enlarged they could lay down coal at all ports of Ontario bordering on the great lakes and Georgian bay.

IRON ORES OF ONTARIO.

Iron ore is found over wide areas in Frontenac, Lanark, Renfrew, Leeds, Hastings, Peterborough and Haliburton counties, in the eastern part of Old Ontario, but most of the deposits are now believed to be merely pockets. Prospectors have been too ready to assume that when several deposits of ore are found in line with each other they must be outcrops of the same ore bed. There appear to be a great number of separate deposits, many of them containing considerable quantities of ore, but as yet no very extensive body of good ore has been proven to exist in that part of Ontario. However, the country has never been thoroughly prospected and very little development work has been done. Magnetites are more common than hematites. Bog ore is reported to exist in Lanark county.

Considerable quantities of both magnetite and hematite iron ores were shipped to the United States a number of years ago, and very favourable reports of the quality of some of the ores were received from the smelting companies, but when the great iron ore beds on the Michigan shore of lake Superior were discovered these eastern Ontario mines were abandoned. It is difficult now to ascertain what was proven by these old-time mining operations. It is certain that in some cases the analyses showed the ores to be high in iron, low in both phosphorus and sulphur and free from titanium, but in other cases the ores were low grade and contained rather high percentages of sulphur, phosphorus or titanium. Some of the deposits seem to be irregular in quality, inferior ore being found in close proximity to first-class ore. It would probably be correct to say that in general the ores of eastern Ontario have a high percentage of iron, are low in phosphorus and titanium and rather high in sulphur, but that there are exceptions. In some sections the magnetite ores contain a large percentage of titanium.

The Ontario Government for some years offered a bounty of one dollar per ton for pig-iron made from Ontario ore, and the Dominion Government while giving iron bounties discriminated in favour of pig-iron smelted from Canadian ore, but these inducements brought out very little eastern Ontario ore. However it would be a mistake to assume too readily that no ore deposits of great value will be found in eastern Ontario. It is probable that a good deal of ore will be taken from some of the mines already opened, and development work in some of the localities yet unworked may reveal valuable ore beds. The Belmont mine near Cordova mines, Hastings county, is said to have a large quantity of magnetite ore averaging a little over 51 per cent of metallic iron. The mine has recently been reopened and shipments are being made to the blast furnaces of the Buffalo Union Furnace Company at Buffalo and to the blast furnace at Port Colborne, Ont.

Farther north in Ontario iron ore has been found at many points from lakes Timagami and Timiskaming to Sault Ste. Marie, but no important iron ore bodies have been proven to exist in this region east of Sudbury.

About 35 miles north of Sudbury near the village of Sellwood in the township of Hutton is the much talked of Moose Mountain iron range which promises to yield very large quantities of low grade magnetite. By crushing the ore fine and passing it through a Grondal magnetite separator a concentric is evolved with a high percentage of iron and very low in both phosphorus and sulphur. A large modern Grondal concentrating and briquetting plant with a capacity of 800 tons of crude ore per day has been installed. Cheap electric power is obtained from a waterfall a few miles away. A branch of the Canadian Northern railway carries the ore from the mines to Key Harbour on Georgian bay.

The Atikokan iron range on the line of the Canadian Northern railway about 130 miles west of Port Arthur is believed to contain large quantities of magnetite high in sulphur and varying in phosphorus content from very low to rather high. The Atikokan Iron Company smelt this ore in blast furnaces at Port Arthur after roasting it in furnaces which reduce the sulphur content from 2·5 per cent to ·75 per cent and expel the moisture from the ore and it is claimed that the cost of the process is only 10 cents per ton.

The Michipicoten mining district takes its name from the Michipicoten river, which empties into a large and beautiful bay of the same name on the north shore of lake Superior, directly opposite the Marquette iron district on the Michigan side of the lake, where nearly all the iron ore used in the blast furnaces of the northern states is mined. Several deposits of iron ore have been discovered in the Michipicoten district. The ore varies in quality, some of the deposits being low in both phosphorus and sulphur and containing a high percentage of iron, but the high grade deposits suitable for use in a Bessemer furnace appear to be limited in quantity so far as yet discovered. The deposits of non-Bessemer ore seem to be much more extensive and millions of tons of red hematite averaging 55 per cent of iron have been taken from the Helen mine which is connected by a railway 12 miles long with large ore shipping docks at Michipicoten harbour. Another mine of the district from which large quantities of ore have been taken is the Magpie producing siderite which is roasted before being shipped. Both these mines are operated by the Algoma Steel Company, a subsidiary company of the lake Superior Corporation at Sault Ste. Marie

THE GREATEST NICKEL MINES IN THE WORLD.

Ontario has in the Sudbury district the greatest nickel mines in the world and supplies over two-thirds of the world's consumption of nickel. Dr. A. P. Coleman has prepared for the Canadian Department of Mines a very interesting report of over 200 pages describing the nickel deposits of the Sudbury district from which the following information is condensed. The town of Sudbury, from which the mining region takes its name, lies about 35 miles north of Georgian bay. It may be reached from Montreal by a journey of 439 miles westward on the main line of the Canadian Pacific railway or from Toronto by a journey of 260 miles north on the Canadian Pacific railway or the Canadian Northern railway. The nearest nickel mines are about two miles to the north and three miles to the west. The smelting is mostly done at Copper Cliff, a short distance from the town of Sudbury.

The nickel region has sharply defined geological boundaries, all the ore deposits being connected with a single great sheet of eruptive rock, roughly boat-shaped, having its interior filled with sedimentary rocks. The basin is 36 miles long and 16 miles wide and the known ore deposits are all either along the edge of the sheet or less than four miles away from it. The nickel deposits are not distributed uniformly around the basin. There are rich portions separated by barren portions. Along a somewhat irregular line of 33 miles on the southern margin of the nickel bearing eruptive seventeen mines have produced nickel ore and within two or three miles to the south of it ten other mines have been worked. While some of the deposits appear to be pockets there are a number of extensive bodies of ore. It is believed that the Canadian Copper Company has enough ore in two of its mines to last for sixty years, while there are a number of other mines supposed to contain great quantities of ore. The whole nickel basin includes an area of 550 square miles, divided among twenty-four townships of the regular size and shape. Mining has taken place in eight of these townships, while important ore deposits are known to exist in several others. The Sudbury ores are sulphides, containing on the average about 45 per cent of iron, about 3·09 per cent of nickel, 2·12 per cent of copper and small quantities of cobalt, gold, silver, platinum and palladium. Bessemer nickel copper matte contains from 2½ ounces to 7 ounces of silver, 0·02 ounce to 0·3 ounce of gold and 0·17 to 0·5 ounce of platinum and palladium per ton.

The iron content of the ore is thrown out and wasted in the smelting process, the aim being to produce a nickel-copper matte suitable for shipment to the refineries in the State of New Jersey and in Wales.

The Sudbury ores all contain large quantities of sulphur and the first process to which they are subjected is roasting to remove part of the sulphur. They are then smelted in water jacket furnaces producing a matte which is resmelted in Bessemer converters, making a matte containing from 75 to 80 per cent of nickel and copper, of which less than half is copper. In the roasting process the sulphur thrown off is entirely wasted. It destroys all vegetation in the neighbourhood.

In the year 1913 the mine owners valued the nickel-copper matte as it was shipped abroad for refining at $7,076,945. After refining the nickel alone was valued at $14,903,032, and the copper at over $3,950,000 while the platinum and palladium were worth about $43,800, a total of nearly nineteen million dollars.

Deposits of low grade nickel have been reported in a number of other localities in Ontario. The Alexo mine in Dundonald township near Matheson in northern Ontario is said to have the most promising nickel deposits outside of the Sudbury district. The discovery of a new nickel range near Schreiber on the Canadian Pacific railway has been reported. Small quantities of nickel ore are found in the Cobalt silver ores.

Large quantities of Canadian nickel have been used in making nickel steel for armour plate of warships. Nickel steel is also much used in the manufacture of motor cars. It is coming into use for structural steel in bridge building as it has been found that steel containing from 2½ to 3½ per cent of nickel has greater tensile strength and greater elasticity than the ordinary structural steel. Another alloy of nickel is known as Monel

Toronto, King street, near Bay street.

Yonge street, Toronto.

metal. It consists of from 62 to 72 per cent of nickel with the balance copper, except for trifling quantities of iron, sulphur and carbon. The alloy can be produced directly from the nickel-copper matte at a cost not greatly exceeding that of copper. It is silver white, takes a brilliant polish, which slowly turns greyish on exposure, melts at 1350° C., has the same specific gravity as copper and can be cast or rolled and treated in various ways like copper or steel, but is distinctly stronger than ordinary steel or than manganese bronze. It has been suggested that iron kitchen utensils might be made clean, white and untarnishable by plating them with nickel.

OTHER COPPER BEARING ORES.

Besides the copper which is associated with nickel in the Sudbury district and near Matheson copper sulphides have been found in the North Hastings, Parry Sound, Timiskaming and Timagami districts, and in the section west of Port Arthur, but their extent and value is unknown as there has been no development work. Small quantities of native copper have been found on the shores of lake Superior, but as yet not in economic quantities. Between the Sudbury district and Sault Ste. Marie along the north shore of lake Huron and extending northward for forty miles is a district in which many discoveries of low grade copper ores have been made. It is believed that there are large quantities of copper ore but no economic method of concentration has been introduced and all the mines that were opened have suspended operations. The Bruce and Walker mines in this district were at one time much talked about. Large quantities of ore were taken out. In the year 1913 with the exception of three tons all the copper produced in the province came from the nickel ores of the Sudbury mines and the Alexo mine.

THE COBALT SILVER MINES.

Next to the famous Klondyke gold discoveries in the Canadian Yukon the most sensational mineral discovery of Canada was made in the year 1903 in the district of Timiskaming a little to the west of lake Timiskaming, where extensive deposits of silver-cobalt ores containing an extraordinarily high percentage of silver were found. During the first ten years that the mines were worked 185,500,000 ounces of silver were taken out. Many mines were opened and a number of companies were formed some of them paying very large dividends to their stockholders. The total dividends declared by these mining companies from the beginning of operations in 1904 until the end of 1913 amounted to $48,922,130. The ores containing phenomenal quantities of silver have been depleted in some of the mines, and ores of lower grade are being worked, so that to produce the same quantity of silver as formerly it is necessary to handle more ore, use more machinery and employ a larger number of men.

There were thirty-five producing mines in this district in 1913, and the quantity of silver produced was 29,681,975 ounces, about 14 per cent of the world's production of silver.

It is estimated that the ores and concentrates as shipped from Cobalt contain on the average 3·20 per cent of cobalt, 1·47 per cent of nickel and 14·28 per cent of arsenic. Some of the ores contain much larger quantities of cobalt and it was the original discovery of ores remarkably high in

cobalt that gave the name to the district. The smelting companies that buy the ore from the operators of silver mines usually pay nothing for the cobalt, nickel and arsenic and an exact record of the production of cobalt is not obtainable, but it is estimated that from the opening of the mines to the close of 1913 between sixteen and seventeen million pounds of cobalt were taken out. This is believed to be greater than the cobalt production of all other countries, but the world's consumption of cobalt is not great.

However, Dr. Herbert T. Kalmus, who recently conducted a series of experiments in electro-plating with nickel at Queen's University, Kingston, Ontario, for the Mines Branch of the Canadian Department of Mines, reports that a solution of cobalt known as XIII B is capable of electro-plating at a speed of at least fifteen times as great as nickel, that the cobalt deposited at this rapid speed is very much harder than the nickel deposited in any commercial nickel bath, and that consequently a lesser weight of this hard cobalt deposit will offer the same protective coat as a greater weight of the softer nickel deposit, so that for many purposes one-fourth the weight of cobalt as compared with nickel is required. Dr. Kalmus says that no nickel solution begins to compare with solution XIII B for the range of work which it will do and for the extreme high current densities at which it will operate, and that it is possible to get a plate in five minutes or less with solution XIII B which will stand bending tests and will buff as satisfactorily as a plate which has taken one hour from the usual nickel-plating baths. The cobalt plates take a very high polish with a beautiful lustre, which although brilliantly white possesses a slightly bluish cast. The director of the Mines Branch believes that as a result of these discoveries there will soon be a large demand for cobalt for electro-plating.

The quantity of refined arsenic produced in 1913 from the silver ores of the Cobalt district was estimated to be 2,450,758 pounds.

Silver has been found at a number of other points in northern Ontario, but the production outside of the Cobalt district was valued at only about $25,000 in 1913.

Many years ago silver was discovered in large quantities on a tiny island about 90 feet square in lake Superior near Thunder Cape. When the mine was abandoned in 1884 work had been carried on to a depth of 1,160 feet and it is estimated that silver to the value of $3,500,000 had been extracted.

THE PORCUPINE GOLD DISTRICT.

The output of gold in the province of Ontario for the year 1913 was 220,837 ounces, valued at $4,558,518 of which $4,294,113 represented the production of the Porcupine lake district about 120 miles northwest of the Cobalt silver district. The first important discoveries of gold in this district were made in 1909 and there are now seven mines producing gold. There are also gold producing mines at Kirkland, Swastika and Larder lakes in the district between Cobalt and Porcupine lake. Gold is produced in small quantities in the Parry Sound district, in the district north of lake Huron, at Michipicoten near the iron mines and in the vicinity of Shebandowan lake, Sturgeon lake and the lake of the Woods. In south-eastern Ontario gold has been found in Peterborough, Hastings, Lennox and Addington counties. Recently sensational discoveries of gold have

been reported a few miles from Kowkash, on the line of the National Transcontinental railway, in Northern Ontario, but the extent of the deposits is uncertain.

SALT IN ONTARIO.

Salt of superior quality is produced in Huron, Bruce, Middlesex, Lambton and Essex counties in the southwestern peninsula of Ontario, the principal plants being located at Windsor, Sarnia, Sandwich, Goderich, Clinton and Kincardine. Salt beds have been proved to underlie a territory 2,500 square miles in extent fronting on the shore of lake Huron between Kincardine and lake Erie and reaching inland at its greatest breadth to a distance of about 40 miles. In some cases the water naturally in filtrating through the rock salt produces a brine which is pumped up, but in many cases it is necessary to pour water into bore-holes sunk to the salt beds and pump it up again after it has dissolved the salt, forming a brine. Samples of salt produced at Goderich, Ont., have been compared with samples of rock salt of Cheshire, England, the most productive salt field of Great Britain. An anlysis of this English salt taken from a report to the British House of Commons showed that it contained eleven times more impurities than the Canadian salt contains. The purity of the Ontario salt makes it particularly suitable for the manufacture of caustic soda and bleaching powder.

OTHER MINERALS OF ONTARIO.

Amber mica is found in many localities of eastern Ontario in a district having an area of about 900 square miles. There were eight mines producing small quantities of mica in 1913, the most important being in Frontenac county.

Graphite mines are being operated at Brougham in Renfrew county, Cardiff and Monmouth in Hastings county, and North Elmsley in Lanark county. The graphite is prepared for the market in mills located near the mines. The quantity produced is not large.

Small quantities of lead are being mined in Frontenac county.

There is a large body of talc near Madoc, in Hastings county. Three mines are in operation, with grinding mills near the mines, and 17,888 tons of ground talc were produced in 1913.

Corundum of fine quality has been discovered at a number of points within a belt about seventy-five miles long extending through Haliburton, Hastings and Renfrew counties. The production in 1913 was 2,354,000 pounds.

Clays or shales suitable for the manufacture of bricks, pottery, tiles, sewer pipes, etc., are widely distributed in the province.

Limestone is abundant in southern Ontario. Granite is quarried in Hastings, Leeds, Muskoka and Parry Sound; marble in Hastings and Lanark; sandstone in Carleton, Halton and Peel; trap rock in Peterborough county, near Bruce mines, on the north shore of lake Huron, and in the vicinity of Thunder bay; while slate has been found near New Liskeard in the Nipissing district.

High grade feldspar is produced in Frontenac county. The whole product of the mines was formerly shipped to pottery works in Ohio and

Queen street Toronto.

Richmond street, Toronto.

New Jersey, but recently the establishment in Kingston of a factory for the manufacture of floor and wall tile has created a local market for feldspar. The quantity of feldspar produced in 1913 was 18,615 tons.

A large deposit of fluorspar has been discovered in Hastings county near Madoc.

There are a number of important pyrites deposits in Hastings county, and several mines are being operated. They are also found in many localities north of lake Superior and are being mined in the Michipicoten district. Part of the ore is used in sulphuric acid plants in the province and part exported to the United States. The output in 1913 was 71,620 tons.

Gypsum deposits of very fine quality are worked in Haldimand county, along the banks of the Grand river. The production in 1913 was 40,581 tons.

There are a number of deposits of barytes in Lanark, Renfrew, Peterborough and Victoria counties in eastern Ontario, on Jarvis, McKellar and Pie islands in lake Superior, and in northern Ontario near the Wanapitei river.

Zinc has been discovered at Rossport in the Thunder Bay district, and at Long lake in Frontenac county, but only small quantities have been mined.

Renfrew, Addington and Haliburton counties in eastern Ontario have molybdenum deposits, but their extent does not appear to have been ascertained.

A GREAT NATURAL GAS FIELD.

There is an extensive natural gas field underlying the part of Ontario bordering on lake Erie and extending from the western end of lake Ontario to lake St. Clair and river St. Clair. At different points in this district new discoveries of gas are being made from time to time. At present there are gas wells in operation in Wentworth, Welland, Haldimand, Norfolk, Kent, Elgin and Lambton counties. For the year 1913 the output was estimated to be 12,558,400,000 cubic feet of gas. The gas is of remarkably uniform quality throughout the district, being noted for the absence of carbon dioxide and for its high calorific value, which is estimated to be over 800 British thermal units. The cheapest artificial gas in Ontario is sold in Toronto, where the price is 70 cents per thousand for a gas with a calorific value of about 600 British thermal units. On the same basis of value per heat unit as Toronto artificial gas, it is estimated that the natural gas now consumed in Ontario is worth over eleven million dollars annually and that its use means the saving of a great quantity of coal. The natural gas is not only being piped to cities and towns, but is used in many farm houses.

Recently gas has been discovered in Russell county, at Bourget, about 26 miles from Ottawa.

PETROLEUM IN ONTARIO.

Petroleum has been discovered at many points in the southwestern peninsula of Ontario, but the most productive wells are in Lambton county, the Tilbury district in Kent county, and the Onondaga district in Brant county. Oil was first discovered in Lambton county in 1862 and

the production of oil has continued ever since. The greatest production of the Ontario wells was in 1895, when the output was about 830,000 barrels of oil. In 1913 the production was only 226,165 barrels. There are five companies refining Canadian crude oil, one in Sarnia, two in Petrolea, one in Wallaceburg, and one in Toronto. Owing to the decline in the production of crude oil the refining companies are importing considerable quantities of crude oil from the United States.

THE FORESTS OF ONTARIO.

The province of Ontario extends over so many degrees of latitude that it possesses a great many kinds of trees. According to reports from saw-mills published in the last report of the Dominion Forestry Branch, twenty-five kinds of trees were cut in the saw-mills of the province, including white pine, red pine, hemlock, spruce, maple, elm, birch, jack pine, basswood, cedar, beech, ash, oak, balsam fir, tamarack, aspen poplar, balsam poplar, cottonwood poplar, chestnut, hickory, butternut, cherry, black gum, walnut, tulip, sycamore, sassafras, willow, and ironwood. The wood most largely cut into lumber in this province is white pine; hemlock comes second, red pine third, spruce fourth and maple fifth in quantities cut.

The late Mr. Aubrey White, for many years Deputy Minister of Lands and Forests in the province of Ontario, stated in a paper read before the Forestry Association in 1904 that the province of Ontario had 20,000 square miles of timber subject to license within the older part of the province, south of the Mattawa river, lake Nipissing, French river and Georgian bay, most of these timber limits being along the Ottawa river and its tributaries, the rivers flowing into Georgian bay and lake Huron and the Trent river system. He estimated the quantity of red and white pine still standing on these licensed lands at 7,000,000,000 feet board measure of which he thought about two-thirds was white pine. He did not estimate the quantities of other kinds of timber, but said there were immense quantities of spruce, hemlock and jack pine. In northern Ontario between the height of land and the great lakes he estimated that there were on unlicensed lands 13,500,000,000 feet of white and red pine, probably two-thirds white pine, besides great quantities of spruce, hemlock and jack pine. North of the height of land he said there were enormous quantities of pulpwood. He expressed the opinion that in a few years great pulp and paper mills would be erected at almost every point where the National Transcontinental railway crossed a river and the logs would be floated down the rivers to the mills which would be run with electric power generated at the numerous waterfalls in the district. The situation has changed very little since then. The annual growth would more than offset the present annual cut of timber if forest fires could be entirely prevented. Vigilant measures are now being taken to protect the forests against fire.

CITIES AND TOWNS OF ONTARIO.

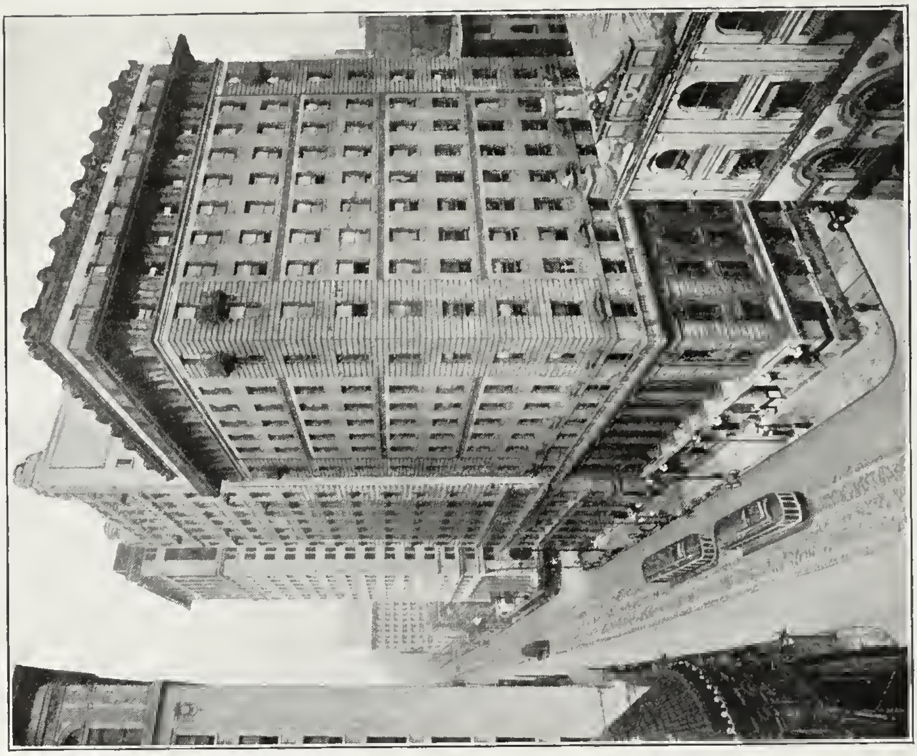
Toronto, the capital of Ontario, is the legal and educational centre as well as the most important railway, manufacturing and wholesale centre of the province. According to the Dominion Government census of 1911 the population was 376,538. In the autumn of 1914 the city assessors estimated the population at 470,144. The city of Toronto directory published early in

1915 estimated the population to be 534,000. The city has an area of 31·98 square miles with 661 miles of streets and 98,419 buildings. In 1910 according to the census the products of Toronto factories were valued at $154,306,948. Many of the factories in the smaller industrial towns have distributing houses in Toronto in order to take advantage of its excellent railway facilities. Toronto is also a great wholesale distributing centre for imported goods. It is famous for its great annual exhibition known as the Canadian National Exhibition, which, while not equal to some of the great world exhibitions which are only temporary in character, is believed to be the most important annual exhibition in the world. It is truly national in its scope and business men of other countries who have never visited Canada could get a great deal of valuable information about the products of Canadian farms, forests, mines and factories by a trip to Toronto during exhibition time which lasts from about the 28th of August to about the 13th of September every year.

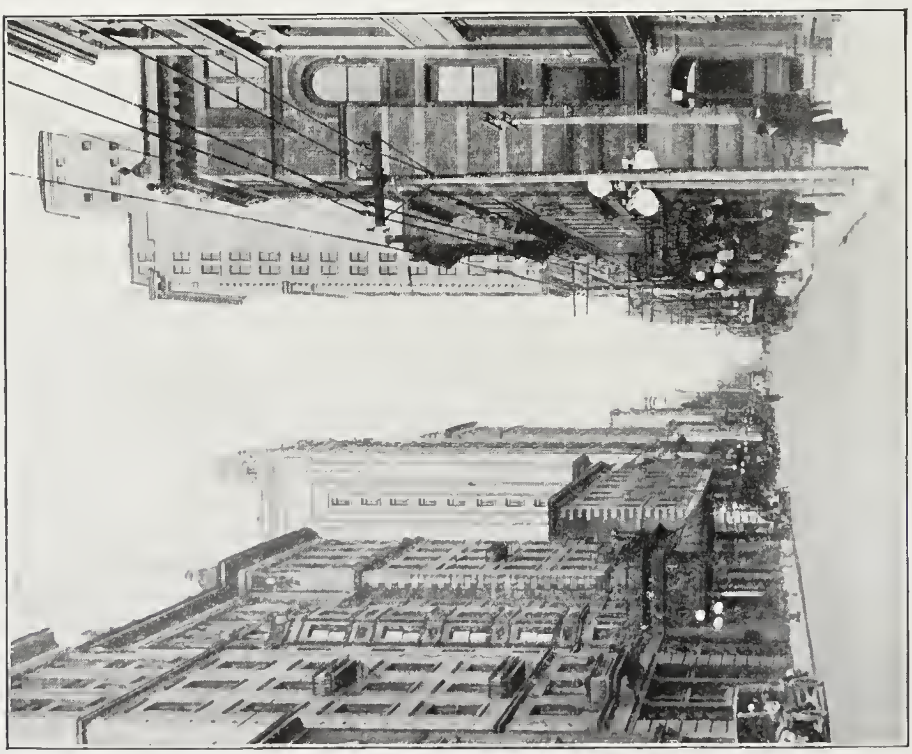
Ottawa, the capital of Canada, situated on the Ottawa river, does not owe its importance entirely to the fact that it is the seat of Government for the Canadian Dominion. Its central situation, its fine railway facilities and the proximity of great water-powers giving it cheap electric power for industrial purposes make it a most favourable location for manufacturing industries. According to the census of 1911 the population of Ottawa was 87,701 and the products of its factories were valued at $20,924,331 as compared with $7,638,688 for the year 1900, an increase of 137·18 per cent in ten years. In 1914 according to the estimate of city assessors the population was 101,795, while the city directory issued early in 1915 estimated the population at 110,000. The city of Hull, in the province of Quebec, directly opposite Ottawa and connected with it by bridges over the Ottawa river, may be regarded as part of Ottawa from a commercial and industrial point of view. If the proposed ship canal connecting the Ottawa river with Georgian bay is constructed it will add greatly to the commercial and industrial importance of both Ottawa and Hull. The beauty of the Canadian Parliament buildings and their commanding situation on a hill overlooking the Ottawa river and the surrounding country call forth the admiration of all visitors to the capital.

The city of Hamilton, situated on Hamilton bay, at the west end of lake Ontario, ranks third among the manufacturing cities of Canada as regards value of output. According to the Dominion census of 1911 its population was 81,969 and the products of its factories during the year 1910 were valued at $55,125,946. The city assessors estimated the population at 102,000 in 1914. In recent years a number of important industries of the United States have established large branch factories in Hamilton. Situated 43·5 miles from Niagara Falls and 38·7 miles from Toronto with excellent shipping facilities by both rail and water, cheap electric power from Niagara Falls and from the De Cew Falls and natural gas piped from wells in the vicinity, it is favourably located for the assembling of all kinds of raw materials from the United States as well as from Canada and their manufacture into finished products.

The city of London, Ontario, has the great disadvantage of always being compared with the world's metropolis because of its name. It has from time to time been proposed to substitute a distinctly Canadian name,



Lower Yonge street, Toronto.



Toronto, King street near Yonge.

but such proposals have always been rejected and it is still London on the river Thames. But the great city in England has no reason to be ashamed of its little Canadian namesake, which is one of the most beautiful cities in the Dominion. It is situated in the interior of the southwestern peninsula of Ontario about midway between Hamilton and the Detroit river. The little river Thames emptying into lake Ontario furnishes navigation for small steamers. The nearest lake port is Port Stanley about 24 miles distant connected with London by a steam railway which is to be converted into an electric line.

The city of Brantford, about midway between Hamilton and London, is situated on the Grand river which is only navigable by small boats at that point, but it has good railway facilities and in proportion to population the products of its factories are greater in value than those of any other Canadian city. According to the census of 1911 its population was 23,132 and the manufactured products were valued at $15,866,229 in 1910. The city assessor estimated the population at 26,389 in 1914.

Peterborough ranks next to Brantford among Ontario manufacturing towns. Situated on the Trent system of navigation, it is about half-way between Montreal and the Detroit river. Its population was 18,360 in 1911, and its manufactured products in 1910 were valued at $10,633,119 according to the census. In 1914 the city assessors estimated the population of Peterborough to be 20,653.

Kingston, at the east end of lake Ontario, had a population of 18,874 in 1911, a little greater than that of Peterborough, but its manufactured products were valued at only $3,860,142 in 1910. The population was 21,261 in 1914, as estimated by the city assessors. Kingston is an important educational centre, having Queen's University, the School of Mining, and the Royal Military College. When the enlargement of the Welland canal is completed it is likely to become a very important transhipment port, as the largest lake vessels will come down from the upper lakes and tranship their cargoes at Kingston to boats drawing not more than 14 feet of water which can run through the St. Lawrence canals to Montreal. The Rideau river, lakes and canals extending between Kingston and Ottawa form one of the most lovely scenic routes in the Dominion for small pleasure steamers.

Berlin with a population of 15,196 in 1911, and Waterloo with a population of 4,359, although separate municipalities are practically one city as they are contiguous. Berlin's output of manufactures in 1910 was valued at $9,266,188 and Waterloo also made a good showing. The city of Galt, which is only a few miles from Berlin and connected with it by an electric railway, had a population of 10,299 in 1911 and was estimated to have about 12,000 in 1914; the output of its factories was valued at $5,252,600 in 1910. The little manufacturing towns of Preston and Hespeller lie between Berlin and Galt. The five towns, Waterloo, Berlin, Preston, Hespeler and Galt are so close together that they are likely to grow eventually into one industrial centre. Their joint population according to the census of 1911 was 35,705, and it was estimated to be over 42,000 at the end of 1914.

Guelph with a population of 15,175 in 1911 and a population of 16,799 in 1914 according to the city assessor's estimate, produced manufactured

The Gore, Hamilton, Ont.

James street, Hamilton, Ont.

goods valued at $7,392,336 in 1910. Guelph is known far and wide through its great agricultural college.

Windsor, Sandwich and Walkerville, on the Canadian side of the Detroit river opposite the city of Detroit, are likely to develop into an important industrial city. According to the census of 1911 the joint population was 23,433, and it has greatly increased since the census year as the result of the establishment of a number of large industries. In 1910 Windsor alone produced $3,771,706 worth of manufactured goods.

St. Catharines, which owing to its nearness to Niagara Falls has unusually cheap electric power, had a population of 12,484 in 1911, and produced manufactured goods valued at $6,024,217; its population was 17,296 in 1914 according to the city assessor's estimate. St. Thomas with a population of 14,054 in 1911 and an estimated population of 17,029 in 1914 produced manufactured goods valued at $3,573,820 in 1910. Stratford with a population of 12,946 in 1911 and an estimated population of 17,500 in 1914, produced goods valued at $5,133,840 in 1910. Chatham with a population of 10,770 in 1911 and an estimated population of 12,714 in 1914, made goods valued at $5,023,560 in 1910. Owen Sound, on Georgian bay, with a population of 12,558 in 1911, is an important grain transfer point. Its manufactured products were valued at $2,852,267 in 1910.

Fort William and Port Arthur, the towns at the head of navigation on the Canadian side of lake Superior, are only three miles apart and are connected by electric railway. Whether they amalgamate or not they are certain to grow together and become a very large city. In 1911 the population of Fort William was 16,499 and that of Port Arthur 11,220. In 1914 the city assessors estimated the population of Fort William at 27,176 and that of Port Arthur at 18,325. The position of these cities makes them the transfer point between lake and rail transportation in the traffic between Eastern and Western Canada. Here are located the greatest grain elevators in the world. In 1910 the value of manufactured products of the two towns was only $1,507,765, but a number of important industrial plants have since been established there. Cheap electric power is obtainable from the Kakabeka waterfall, and the facilities for assembling raw materials are admirable, while the railway freight rates for the shipment of manufactured products to the western provinces are favourable. Sault Ste. Marie, Ontario, popularly known as the Canadian Sault owing to its cheap electric power and strategic position on the great Sault canal, offers many advantages to manufacturers. It is noted for its large steel works and its pulp and paper industry. Its manufactured products were valued at $1,002,834 in 1910. The population of Sault Ste. Marie was 10,984 in 1910 and was estimated to be 12,397 in 1914. The town of Niagara Falls, which had a population of 9,320 in 1911 and was estimated to have 11,340 in 1914, has a number of important manufacturing industries run by electric power. Belleville, Brockville, Woodstock and Sarnia each had nearly 10,000 inhabitants in 1910, while North Bay, Oshawa and Collingwood had each over 7,000. Lindsay, Orillia, Cornwall, Barrie, Smiths Falls, Kenora, Pembroke, Welland, Port Hope and Cobourg ranged in population from 5,000 to 7,000.

Kaministiquia River, Fort William.

Port Arthur, Ontario.

THE DISTRICT OF PATRICIA.

At the same time that Ungava was added to the province of Quebec the province of Ontario was enlarged by the addition of the district of Patricia, a territory 146,400 square miles in extent, bordering on the west side of James bay and Hudson bay, to the north of the English and Albany rivers. The province of Ontario was also given land ownership of a strip of land five miles wide extending northward from the district of Patricia through the province of Manitoba, for the purpose of constructing an extension of the Ontario Government railway to Nelson river and ample space on the south shore of the Nelson river for railway terminals. This five-mile strip of land is not included in the area of the province of Ontario, as it is under the jurisdiction of the province of Manitoba. It is really a land bonus to encourage the construction of a government railway similar to land bonuses granted to railway companies.

A farm lawn in Ontario.

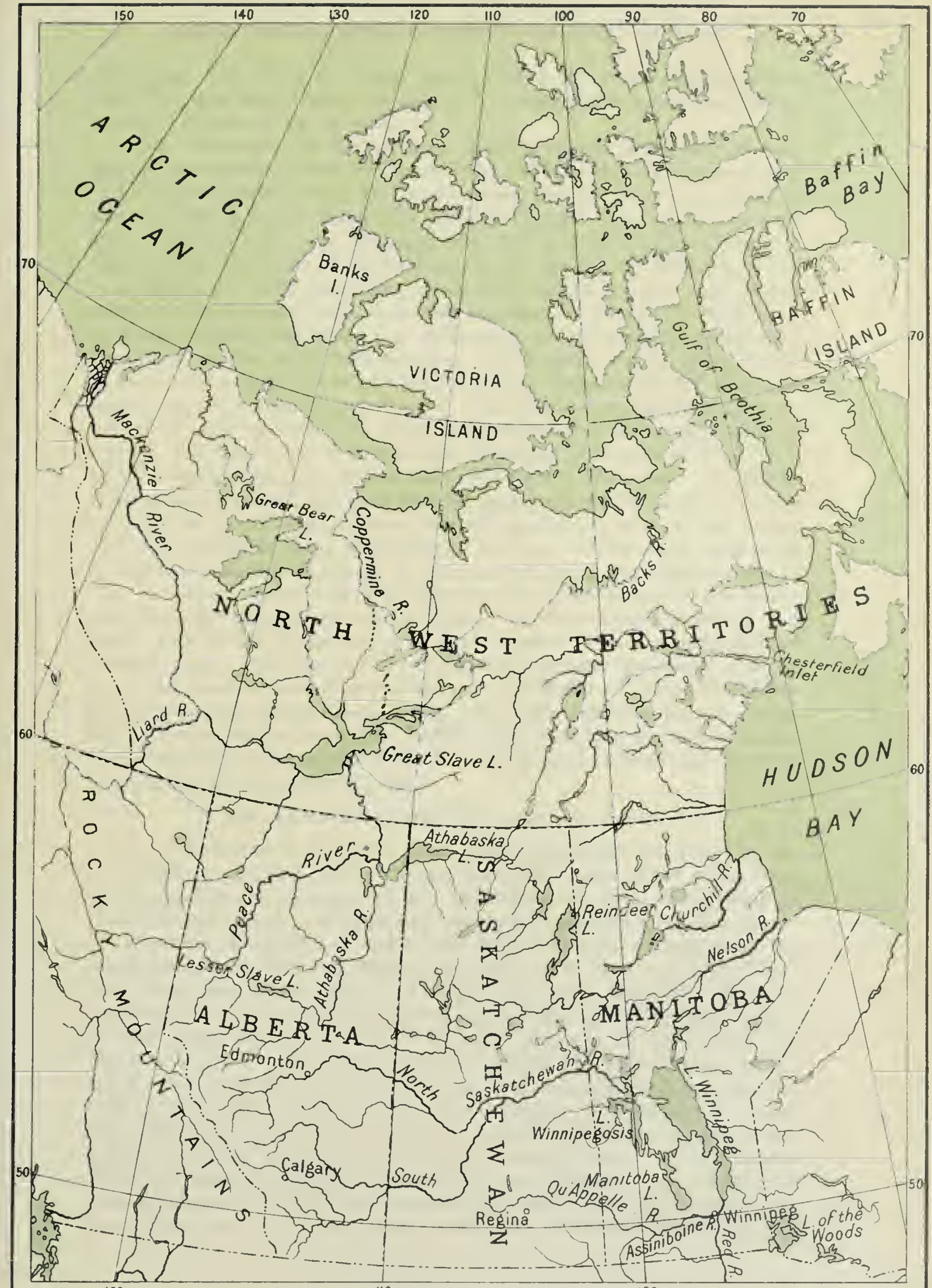
Chapter IX.

THE WESTERN PLAIN.

The part of Canada extending from the western boundary of Ontario to the Rocky Mountains and from the United States boundary to the Arctic ocean has been known by different names in the course of its history. For a long time it was generally known as the Hudson Bay territory, but was sometimes called Prince Rupert's Land and often referred to as the Great Lone land. After it became part of Canada it was known for a number of years as the Canadian Northwest. In recent years it has been more frequently called Western Canada, although this name should properly include British Columbia. Perhaps the most appropriate name is the Western Plain of Canada which distinguishes it from the mountainous province of British Columbia. Politically the Western Plain has been subdivided into the three Prairie Provinces, Manitoba, Saskatchewan, Alberta and the Northwest Territories. Each of the Prairie Provinces extends from the United States boundary to the 60th parallel of latitude, while the Northwest Territories include the whole of the Western Plain north of the 60th parallel of latitude.

THREE GREAT RIVER SYSTEMS.

The Western Plain has three great river systems with lake reservoirs, the Nelson and Churchill rivers draining into Hudson bay and the Mackenzie draining into the Arctic ocean. Besides the rivers included in these three systems there are the lakes and rivers which empty their surplus waters into Chesterfield Inlet at the northern part of Hudson bay, the most important of which are the Thelon, Dubawnt and Kazan rivers, and the rivers emptying into inlets of the Arctic ocean, the largest of which are the Backs and Coppermine rivers. The chief reservoirs of the Nelson system are lake Winnipeg, lake Winnipegosis and lake Manitoba, which receive the waters flowing from the western prairies through the channels of the Saskatchewan, Red, Assiniboine and other rivers as well as those of the Winnipeg and English rivers coming from the lake of the Woods and lake Seul. The Nelson river carries the surplus waters of these lake reservoirs to Hudson bay in the same way that the St. Lawrence river carries the waters of the great international lakes to the ocean. The most important river of the prairie country is the Saskatchewan which has two branches rising near together in the foothills of the mountains, but flowing in tortuous courses one south the other north and finally joining in a common channel which carries their waters to lake Winnipeg. In the lower part of its course the Saskatchewan has a number of small lake reservoirs including among others Cumberland, Namew, Saskeram and Cedar lakes, which receive the overflow from a number of other small lakes and rivers of the north. The most serious obstruction to navigation on the Saskatchewan is a waterfall or rapids beginning a short distance above its entrance to lake



THE WESTERN PLAIN

Winnipeg. The Red river rising in the United States flows northward to lake Winnipeg receiving at the city of Winnipeg the winding Assiniboine coming 450 miles from the west.

Lake Winnipeg, having an area of 9,459 square miles, lake Winnipegosis having an area of 2,086 square miles and lake Manitoba with an area of 1,817 square miles are all long and narrow, and extending from north to south provide navigable waterways for long distances in proportion to their area. Steamers run from Winnipeg along the Red river and through lake Winnipeg to the rapids of the Saskatchewan a distance of 286 miles. The construction of two or three short canals, the removal of a few boulders and a little dredging would make it possible for steamers to run from Winnipeg to Prince Albert, Battleford and Edmonton on the north Saskatchewan, Saskatoon on the south Saskatchewan, and Brandon on the Assiniboine. However the prairie rivers although long are neither wide nor deep and will never accommodate large vessels. The Nelson is a large river, but at present is only navigable for about sixty miles from its mouth owing to rapids. The upper part of it near lake Winnipeg is a series of small lakes which are sometimes regarded as extensions of lake Winnipeg. The Hayes river rising in a small lake near lake Winnipeg and emptying into Hudson bay near the mouth of the Nelson river although not so great a river as the Nelson is navigable for a much greater distance. It has been much used by the Hudson's Bay Company in transporting goods from Hudson bay to lake Winnipeg. A short portage separates the upper waters of the Hayes river from the upper waters of the Nelson. At Hudson bay the Nelson and Hayes rivers form an estuary and York Factory is on a tongue of land between them. The Churchill river has for its reservoirs a host of lakes large and small extending across the country almost as far as lake Athabaska, including among others Indian lake, Granville lake, Reindeer lake, lake la Ronge, Isle la Crosse lake, Buffalo lake, Clear lake and lake la Loche. Port Churchill at the mouth of the river has a good harbour and the river is navigable for a number of miles.

THE MACKENZIE SYSTEM OF RIVERS AND LAKES.

The Mackenzie is almost as great a system of lakes and rivers as the St. Lawrence. Its first reservoir is the Lesser Slave lake out of which flows the Lesser Slave river, emptying into the Athabaska river, which rising in the Rocky mountains discharges into lake Athabaska after a winding course of 765 miles. A little to the west of lake Athabaska is lake Claire about the same size as lake St. Clair which lies between lake Huron and lake Erie, and between lake Claire and lake Athabaska is a small lake called Mamawi, the three lakes being connected by very short rivers. The Great Slave river connects lake Athabaska with Great Slave lake, out of which flows the Mackenzie proper to the Arctic ocean, being joined at Fort Simpson by the Liard river from British Columbia, and receiving still farther north the outflow from Great Bear lake. The chief tributary of the Mackenzie is the Peace river, which rising in the mountains of British Columbia makes connection with the lower end of lake Athabaska by means of the Quatre Fourches channel, a short river running down between lake Claire and lake Athabaska, but the Peace empties the greater part of its waters into Great Slave river by another mouth, twenty-five miles below. In the spring,

when the Peace river is high, the water runs out of the Quatre Fourches river into the lake; in the summer, the water runs out of the lake into the river. From its mouth to the Rocky mountains, a distance of 740 miles steamboat navigation on the Peace river is only interrupted even at low water by rapids or waterfalls in two places, having an aggregate length of 5¼ miles. At ordinary stages of the water the only obstruction to navigation is Vermilion falls or rapids above which the river is navigable for about 550 miles.

The Peace river has four important tributaries, the Finlay, 250 miles long, the Parsnip, 145 miles long, the Smoky, 245 miles long, and the Little Smoky, 185 miles long, but the Finlay and the Parsnip, as well as the upper reaches of the Peace, are in the province of British Columbia. There are several smaller tributaries navigable for short distances.

The Mackenzie proper is 1,037 miles long, with an average width of about one mile and a quarter, and there appear to be no obstructions to navigation throughout its course. In some places it is over two miles wide. A little south of Fort Simpson the river narrows and for a distance of 70½ miles is only about half a mile wide. This part of the river is sometimes called the Narrows, but is more commonly known as "The Line," because men rowing up the river sometimes attach a line to their boat at the Narrows and walk along the bank pulling the boat up stream in preference to rowing against the swift current. Above Fort of Good Hope for a distance of about seven miles the Mackenzie river runs between high walls of rock called the Ramparts. At the upper end of the Ramparts the river narrows to a width of about five hundred yards and its depth is about three hundred feet. It gradually widens to a mile at the lower end of the Ramparts. Just below Fort McPherson the Mackenzie is divided by islands into four channels through which the waters of the river run to the Arctic ocean. The Hudson's Bay Company has for a number of years run steamers from Fort Smith on the Great Slave river to Fort McPherson, a distance of 1,273 miles. Going down stream the trip is made in a little over five days. Going up it takes about nine days. The captain of one of the Hudson's Bay Company steamers stated some years ago that the shallowest water anywhere in the Mackenzie river channel was 11 feet deep. By dredging a few shoal places the depth could be increased. It has been estimated that the Mackenzie and its tributary rivers without including the lake reservoirs of the system furnish over 2,800 miles of navigation for stern-wheel steamers. Great Bear lake has an area of 11,821 square miles, Great Slave lake an area of 10,719 square miles, lake Athabaska, 2,842 square miles, lake Claire 404 square miles, and Lesser Slave lake 480 square miles, a total of 26,266 square miles, as compared with 17,705 square miles, the combined area of lake Ontario, lake Erie and lake St. Clair. On the Great Slave river above Fort Smith navigation is obstructed by rapids for about sixteen miles. On the Athabaska river rapids interrupt navigation for about 60 miles above Fort McMurray. Above these rapids there is navigation on the Athabaska for small steamers for many miles. During a period of sixteen years the records at Fort Norman, in latitude about 65°, showed that while small quantities of ice sometimes formed in the river early in October, the earliest date at which the river was closed by ice was November 2, and

the latest, November 18. The earliest date at which the ice broke up was May 9, and the latest, May 24. At Fort Simpson, in latitude 61° 52′, the earliest drift ice during a period of ten years' observations was on October 11, while the earliest date at which the river was closed by ice was November 17 and the latest was November 30. The earliest date at which the ice broke up was May 1, and the latest, May 14. So it would appear that the shortest period of navigation is about five months.

There is a height of land starting in the Melville peninsula, northwest of Hudson bay, extending southwestward almost to Slave lake and then running eastward a little north of the 60th parallel of latitude to Selwyn lake, where it turns southward to Wollaston lake, from which it runs westward again to the headwaters of the Churchill river. This height of land, although the elevation is not great, separates the waters flowing into Hudson bay from those flowing into the Mackenzie system of lakes and rivers or directly into the Arctic. At Melhye portage, where the height of land separates the headwaters of the Churchill river from the Clearwater river, which flows into the Athabaska, there is a hill rising about one thousand feet above the general elevation of the portage from which a view is obtained of the Clearwater Valley, described by Sir John Franklin, Sir George Simpson, Sir Alexander Mackenzie, Sir George Back and other famous explorers as one of the most enchanting natural landscapes in the world.

THREE NATURAL SUBDIVISIONS.

The vast Western Plain which is drained by these great systems of rivers and lakes has three great natural subdivisions, the Prairies, the Forest Region, and the "Barren Lands." The Prairie region lies between the United States boundary and the 54th parallel of latitude, sloping gradually eastward from an elevation of over 3,500 feet in the foothills of the Rocky mountains to an elevation of about 800 feet in the valley of the Red river. There is also a steady slope northward, but the eastward slope is a little more pronounced and directs the course of the rivers toward Hudson bay. Throughout the Prairie region there are trees in many spots along the banks of rivers and on the low hills that rise from the plains in some places, but the prairie country as a whole is almost treeless except in the northern part where there is a park-like country having many groves of trees with wide, open spaces between them. This park country may be regarded as the borderland between the Prairie and the Forest region. The Forest region includes the districts lying within the basins of the Churchill and Mackenzie river and lake systems and the country extending east and northeast of lake Winnipeg to Hudson bay. Just as in the Prairie region there are small tree-covered areas, so in the Forest region there are small prairies. The district known as the "Barren Lands" lies east of the watershed of rivers flowing into the Mackenzie system of lakes and rivers and extends from about the 60th parallel of latitude to the Arctic ocean. It is drained by a number of rivers flowing into Hudson bay and by the Coppermine and Backs rivers emptying into the Arctic ocean. As will be explained more fully in the chapter on the Northwest Territories, several well-known explorers are of the opinion that the so-called "Barren Lands" are wrongly named.

THE HUDSON BAY RAILWAY.

The prairie country is fast becoming a network of railways, but as yet the forest belt is almost without railways. A Government railway is being built from the Pas on the Saskatchewan river to Port Nelson, a distance of 418 miles, in response to a long cherished desire of the western settlers for a short route to Europe. It is a remarkable fact that Port Nelson is nearer to British ports than New York is, the distance from Port Nelson to Liverpool being 2,966 miles, as compared with 3,043 miles from New York to Liverpool. It is evident that if Hudson bay and strait were navigable throughout the year the whole export and import business of the Western Plain of Canada would take that route. Unfortunately the ice conditions in Hudson strait are very unfavourable to navigation during the greater part of the year. Commander A. P. Low of the steamship *Neptune*, commissioned by the Canadian Government to study navigation conditions in Hudson bay and Hudson strait, said in his report:—

"Hudson bay and Hudson strait do not freeze solid, but are so covered with masses of floating ice as to be practically unnavigable for at least seven months in the year. The ice does not begin to melt until well into the month of June, and is not sufficiently melted for safe navigation with ordinary steamers until the middle of July. No ice is formed in the strait and bay sufficiently heavy to obstruct ordinary navigation until the latter part of November, but towards the close of this period there is danger from the early passage of the northern pack across the mouth of the strait and also to a much lesser degree from the ice from Fox channel partly closing the western entrance to the strait. The period of safe navigation for ordinary iron steamships through Hudson strait and across Hudson bay to Port Churchill may be taken to extend from the 20th of July to the 1st of November. This period might be increased without much risk by a week in the beginning of the season and by perhaps two weeks at the close."

Commander Low selected Port Churchill as the terminus of the Hudson Bay railway, but Port Nelson was finally chosen. The conditions as regards navigation are practically the same.

Chapter X.

THE THREE PRAIRIE PROVINCES.

While Manitoba, Saskatchewan and Alberta are called the Prairie Provinces as the prairies only extend about as far north as the 54th parallel of latitude while the northern boundary of all three provinces runs along the 60th parallel of latitude, the name may not seem altogether appropriate. However, nearly the whole population of the three provinces is in the prairie country south of the 54th parallel.

Manitoba has an area of 251,832 square miles, Saskatchewan 251,700 square miles and Alberta 255,285 square miles, a total of 758,817 square miles. The three provinces combined have a greater area than the states of Michigan, Indiana, Kentucky, Illinois, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas combined Manitoba is larger than Germany, Belgium, Holland and Switzerland combined; an area as great as Austria-Hungary could be taken out of Saskatchewan and 10,400 square miles would remain; Alberta could give away 8,485 square miles and still have an area as large as Italy, Greece, Montenegro, Servia, Rumania and Bulgaria combined.

Winnipeg, the capital of Manitoba, in latitude N. 49° 53′ is farther south than any city in the British Isles; Port Nelson, the terminus of the Hudson Bay Railway, N. 57°, is in about the same latitude as Aberdeen, Scotland; Regina, the capital of Saskatchewan, N. 50° 27′, is farther south than Portsmouth, England; Saskatoon in Saskatchewan N. 52° 15′ is farther south than Birmingham, England; Calgary in southern Alberta, latitude N. 51° 2′ is farther south than London; Edmonton, the capital of Alberta, N. 53° 33′ is in about the same latitude as Manchester, England; while Dunvegan in the Peace River country, N. 56° is in about the same latitude as Dundee, Scotland.

THE CLIMATE OF THE PRAIRIE PROVINCES.

Throughout the three Prairie Provinces the sky is usually bright and the atmosphere dry, clear and pure. The dryness of the atmosphere makes both heat and cold more endurable. The general good health and energy of the people and the rosy cheeks of the children are indications of the salubrious character of the climate. The cold is often extreme in winter, but the degree of cold is not realized until one examines the thermometer. The temperatures do not vary as much in different sections of these provinces as might be expected in such a wide extent of territory covering so many degrees of latitude. While the elevation increases as one moves westward from the Red river toward the mountains, the western country is farther from the influence of cold winds blowing from the ice in the north of Hudson bay and Hudson strait in the winter and spring and this offsets the higher elevation. In Alberta the influence of the warm Chinook breezes

Experimental Farm, Brandon, Manitoba.

Driveway, Experimental Farm. Brandon, showing how trees will grow on the Prairie.

coming through passes of the Rocky mountains is often felt. These warm winter winds melt the snow in a marvellously short time so that it seldom lies long on the ground and cattle are able to feed on the prairie all winter. Comparing Manitoba and Alberta it may be said that the winters are a little colder and steadier in Manitoba and the summers a little warmer, but the difference is not great. Saskatchewan has very much the same climate as Manitoba and in both of these provinces the winters are less changeable than in Alberta. The large lakes of Manitoba have a moderating influence on the climate. Saskatchewan and Alberta also have lakes, but most of them lie to the north of the Saskatchewan river, while in Manitoba the lakes extend far south in the province. It might be supposed that in provinces extending from 49° N. latitude to 60° N. the northern sections would be much colder than the southern, but the elevation decreases so steadily from south to north that the higher altitude is offset by the lower elevation and there is very little difference in climate. Thus while the elevation is 3,427 feet at Calgary in southern Alberta it is only 600 feet at the extreme north of the province of Alberta. Edmonton in latitude N. 53° 33′ is 1,269 feet lower than Calgary in latitude N. 51° 2′; Dunvegan on the Peace river in latitude 56° N. is 2,099 feet lower than Calgary, while Fort Vermilion on the Peace river in latitude 58° 24′ is 2,454 feet lower than Calgary, and Fort Smith on the Slave river at the northern boundary of the province over 2,800 feet lower. However a great part of the Peace river country has a much higher elevation than the river valley, which is not very broad. The great plateau through which the river flows is from 700 to 1,000 feet higher than the level of the river. As we proceed north beyond the boundary of Alberta into the Northwest Territories the altitude continues to decrease. A good illustration of the decreasing altitude may be found in the levels of the Mackenzie system of lake reservoirs. Lesser Slave lake has an altitude of 1,890 feet, lake Athabaska an altitude of 690 feet, Great Slave lake an altitude of 520 feet and Great Bear lake an altitude of 391 feet.

THE COMING OF THE SPRING.

The spring flowers and the buds of deciduous trees appear as early north of Great Slave lake as at Winnipeg or St. Paul and earlier along the Peace and Liard rivers and some of the minor affluents of the great Mackenzie river. Professor Macoun, the eminent botanist, who made a careful study of this northwestern country, said that the spring begins in the Peace River district and advances southeast at the rate of 250 miles per day, and that winter begins in Manitoba and goes northwestward at the same rate. Many reasons have been assigned for the warm summers in the far northwest. The elevation of the country is thousands of feet lower than at the United States boundary. The British Columbia mountains are much lower at the north and there are many passes in them through which come warm Chinook breezes from the Pacific, while the many lakes in the north favourably affect the temperature, and in the summer there is almost no night there. An American writer has called all Canada "Daylight Land" because of our long summer days. The title seems appropriate to any one coming from the Southern States to Southwestern Canada; it is more apt when we reach the prairies of Manitoba,

Typical Prairie Wheat Field.

Wheat Farm near Edmonton.

Saskatchewan and Alberta; but one must live in the valley of the Peace river from the first of April to the end of September to realize that Canada is indeed "Daylight Land." But while there are long days in summer there are long nights in midwinter and temperatures sometimes register very low. Yet even in the winter there is very little darkness, for when the moon is not shining the brilliant northern lights usually make the night bright.

FARMING IN NORTHEASTERN MANITOBA.

It will be noted that the far northwest owing to local influences is warmer than the far northeast in the same latitude, but the long summer days and the brilliant winter nights are common to both sections. The part of Manitoba northeast of lake Winnipeg is almost without inhabitants excepting hunters and fur traders. There are no farmers and consequently the agricultural capabilities of the country cannot be judged by actual results excepting what may be seen in the gardens of Hudson bay posts where peas, beans, barley, oats, potatoes, turnips, radishes, carrots and cabbages are successfully grown. Black currants, red currants and gooseberries grow wild in great profusion. Wild cherries are often seen. Explorers with scientific knowledge of soils who have examined the country as carefully as possible during hurried trips across its vast expanse have reported that there are great areas of good agricultural lands, and that the country being well watered and having luxuriant grasses is well adapted to mixed farming, especially dairying, but that much of the land will require drainage before it can be utilized. It is not probable that much wheat will ever be grown northeast of lake Winnipeg, but if butter, cheese, eggs, meats and vegetables are produced there in large quantities it will be just as advantageous to Canada as if wheat were largely grown.

Mr. J. B. Tyrrell, C.E., D.L.S., who explored the forest country from Split lake, one of the small reservoirs of the Nelson river northeast of lake Winnipeg, to the Athabaska river, stated that the greater part of this forest belt would be well suited for agriculture if cleared. He estimated that this belt would average about 800 miles wide from north to south. He said that everywhere in travelling through it there was abundant evidence of rich vegetation, and wherever any kind of agriculture had been attempted in this forest belt it had been successful. The summers were warm and the days long, and while the winter was very cold that made no difference from an agricultural point of view as things do not grow in winter. He thought that anything grown in the prairie country farther south would grow there. Mr. Frank Crean, C.E., another explorer, referring to a trip through northwest Saskatchewan in 1908, says: "The first frost registered by my thermometer was on October 2, when the thermometer fell to 24 degrees Fah. I was at Methye portage, latitude N. 56° 36′, on September 17, and the potato tops were not frozen in the least. The garden was also quite untouched. Nor had I seen any frozen vegetables on the way up. The lakes began to freeze on October 20, but remained open for perhaps two weeks, the weather turning quite mild again." In another report of explorations in the same district the following year Mr. Crean said: "Lettuce and radishes in fourteen days grow from the seed to a size fit for table use. On Sunday, July 14, I saw some radishes one and a half inches in diameter, fourteen days' growth."

Main street, Winnipeg.

Corner Portage Avenue and Main street, Winnipeg.

THE GREAT HARD WHEAT BELT.

There is land enough in the great hard wheat belt of the prairie country west of the Red river and lake Winnipeg to produce a very large proportion of the world's present demand. Nearly the whole area of these vast prairies is suitable for wheat growing. Scientific agriculturists say that this is the largest continuous expanse of rich soil on the American continent. In addition to a rich top soil there is a deep subsoil containing great stores of nitrogen, phosphoric acid and potash, so that without the use of fertilizers many crops can be taken off the land in succession, although they point out that even such fertility would be exhausted in course of time if the farmers continued to grow nothing but wheat as many of them are doing. However, mixed farming with rotation of crops is becoming more general. It has been pointed out that many of the settlers have not sufficient capital in the first place to buy live stock or erect buildings suitable for the winter housing of a large number of animals. Wheat farming is easy, and long before the soil is exhausted by continued recropping most of them have acquired sufficient capital to buy live stock and erect buildings. In the province of Manitoba during a period of fourteen years about thirty-six million dollars have been expended on farm buildings, and a great part of this expenditure represents profits in wheat growing.

The three prairie provinces combined have an area of over 485,000,000 acres. In the year 1913 there were 10,036,000 acres in wheat, 5,792,000 acres in oats, 1,025,000 acres in barley, and 2,180,000 acres in rye, flax, mixed grains, peas, hay and clover, alfalfa, fodder corn, potatoes, turnips and other vegetables. The three most important cereal crops amounted to 209,262,000 bushels of wheat, 242,413,000 bushels of oats and 31,060,000 bushels of barley. Suppose that thirteen times the acreage of 1913 were devoted to each of the crops grown that year it would require 246,495,600 acres, not much more than half the total area of the three provinces, and if the yield per acre were the same as in 1913 we would have 2,720,406,000 bushels of wheat, 3,151,369,000 bushels of oats and 403,780,-000 bushels of barley, besides immense quantities of rye, flax, mixed grains, hay, clover, alfalfa, fodder corn, peas, potatoes and other vegetables. In October 1914 the International Institute of Agriculture announced its estimates of the world's production of wheat, oats, and barley to be as follows: Wheat 2,697,000,000 bushels, oats 3,286,000,000 bushels, barley 1,164,-000,000 bushels. Thus a little more than half the area of the three Prairie Provinces if put under cultivation could produce in a good year more than as much wheat, almost as much oats and about one-third as much barley as the whole world was estimated to produce in the year 1914. However, it is probable that when half the area of these provinces is under cultivation mixed farming will be more general so that the production of grain will be less than this estimate, while vast quantities of meats, cheese, butter and eggs will be produced.

THE CHARACTER OF THE WHEAT.

The hard wheat of Western Canada is unquestionably equal if not superior to any wheat grown elsewhere. It has won prizes at many world's

Portage Avenue, Winnipeg.

A manufacturing district, Winnipeg.

exhibitions, but the best proof of the quality of this wheat is its high standing in the leading markets of the world where it is generally known under the name of Manitoba wheat owing to the fact that Manitoba was the first of the western provinces opened to settlement. Flour made from this wheat cannot be excelled in bread making, but it is not suitable for biscuit manufacture. The biscuit manufacturers of Winnipeg use Ontario flour which is particularly suited to biscuit manufacture.

TREES GROW WELL ON THE PRAIRIES.

The Forestry Branch of the Dominion Department of the Interior is endeavouring to encourage the farmers to plant trees on the prairies. The last report of the Director of Forestry stated that in the previous year 2,729,135 trees were distributed to farmers. What may be accomplished in growing trees on the prairie is particularly well illustrated at the Dominion Experimental Farm at Brandon, Mantitoba, and in the city of Brandon itself, where all the residential streets are lined with beautiful shade trees.

NOT FAVOURABLE TO FRUIT TREES.

The climate that produces the finest wheat in the world is not favourable to fruit trees. However with great care certain hardy varieties of apples can be produced in some sections. There are wild plums in Manitoba; a number of the trees were planted on the Dominion Experimental Farm in Brandon some years ago and there is now a fine orchard. The plums, which grow abundantly, are small but of fine flavour. Black and red currants, raspberries and strawberries grow very successfully.

IRRIGATED LANDS.

At one time it was supposed that extensive areas in southern Saskatchewan and Alberta were too arid for farming, and would never be useful except as cattle ranches. Some of these lands have proved to be well adapted to farming even without irrigation, but extensive tracts have been brought under cultivation as a result of irrigation works constructed by the Canadian Pacific Railway Company and other companies. The irrigated land has proved to be as fertile as other sections of the prairie and prosperous farms have taken the place of cattle ranches.

COAL IN THE PRAIRIE PROVINCES.

Lignite of rather poor quality is found in the Turtle Mountain district of southwestern Manitoba covering an area of about 40 miles long and 20 miles wide. While small quantities of this lignite have been mined no mining operations on an extensive scale have ever been undertaken. There are extensive beds of peat in Manitoba. In the Souris district of southern Saskatchewan there is lignite of better quality, beginning a little west of the Manitoba boundary and extending along the United States frontier for about 150 miles with an average width of about 25 miles from south to north. There are a number of small coal mines near Estevan in this district and the present annual output is about 200,000 tons. There are believed to be deposits of lignite extending almost completely across the southern part of Saskatchewan from Estevan to Alberta. In the eastern part of the province of Alberta, both in the southern and northern districts

Rosser Avenue, Brandon, Manitoba.

The shopping centre, Brandon, Manitoba.

there are extensive deposits of semi-bituminous coal, grading between lignite and bituminous. The quality of the coal improves as it extends westward and when the foothills are reached it becomes bituminous, while in the basin of the Cascade river a few miles east of Banff it becomes anthracite in some localities. It has been estimated that there are 400,000,000 tons of anthracite coal and 1,200,000,000 tons of soft coal in the basin of the Cascade river. The total areas of known coal deposits in the province of Alberta including anthracite, bituminous and semi-bituminous coals have been estimated to underlie 30,000 square miles of the province. The principal mining centres of semi-bituminous coal are along the Belly river between Lethbridge and Medicine Hat, and in the vicinity of the city of Edmonton. The principal mines of bituminous coal being operated are along the line of the Crowsnest branch of the Canadian Pacific railway a little east of the British Columbia boundary, while the anthracite mines are near Canmore and Bankhead on the main line of the Canadian Pacific railway.

Recent experiments made by the United States Bureau of Mines with lignites inferior to those of the Prairie Provinces of Canada have demonstrated that cheap power can be produced from them. Referring to these experiments in a report to the Canadian Commission of Conservation, Mr. W. J. Dick says: "It was found that the low grade lignite of North Dakota developed as much power when converted into producer gas as did the best West Virginia bituminous coal when utilized under the steam boiler." The Mines Branch, Canadian Department of Mines made seven ordinary gas-producer trials with lignites and lignitic coals of low calorific values. Good results were obtained in every case, the gas being of high calorific value and uniform in quality. It is believed that in districts where water power cannot be economically developed electric energy can be generated from those lignites and distributed to towns some distance from the mines.

OTHER MINERALS IN THE PRAIRIE PROVINCES.

Gold in small quantities has been found along the Peace and Liard rivers and their tributaries, but there have been no great discoveries of gold anywhere in the Prairie Provinces. While indications of silver have been reported at various points in northern Manitoba, Saskatchewan and Alberta, it has not yet been found in economic quantities.

The fact that the population of the Prairie Provinces is not yet great enough to justify the manufacture of pig-iron and steel, and the great distance from any outside iron-making centre where iron ores could be sold has prevented any systematic search for iron ores, but explorers have reported many indications of the existence of deposits of hematite, limonite and clay ironstone in the northern part of Manitoba, Saskatchewan and Alberta.

Indications of copper, galena, mica and gypsum have been reported in northeastern Manitoba. Marble of high grade is found on Marble island in Hudson bay, and there is also marble at Churchill. Limestone is found in a number of localities in Manitoba, and there are said to be very large quantities near Le Pas. Nickel deposits are reported in the vicinity of lac La Ronge, in northern Saskatchewan, and coal is said to

Scarth street, Regina, Saskatchewan.

Eleventh Avenue, Regina, Sasketchewan.

have been discovered in the same district. If the opinions of trappers, traders and Indians are of any value, there are many other minerals in the northern part of Saskatchewan, but there is little real knowledge of the mineral resources.

In all three Prairie Provinces there are many surface clays and shales suitable for the manufacture of building bricks, and there are a number of deposits that can be utilized for the manufacture of sewer pipes and drain tiles. To describe in detail all the deposits in this wide area would require a large valume. Any one specially interested in the subject of clays and shales may obtain detailed information by consulting the report on the "Clay and Shale Deposits of the Western Provinces," in three volumes, covering 400 pages, prepared for the Canadian Geological Survey by Mr. Heinrich Ries and Mr. Joseph Keel. However, it may be noted that white and grey clays of truly refractory character are found in abundance in the Dirt Hills, south of the city of Moosejaw, Saskatchewan. Associated with them are clay shales of lower refractoriness, and by using proper mixtures of the different beds, firebrick, pressed brick, sewer pipe and stoneware can be made At the city of Medicine Hat, Alberta, and the neighbouring town of Redcliff, clay products are being manufactured on quite an extensive scale. In Medicine Hat, earthenware pots, crocks, demijohns and ornamental flower pots are made from a mixture of local clay and Spokane clay.

Large gypsum deposits are reported near the mouth of the Peace river in northern Alberta.

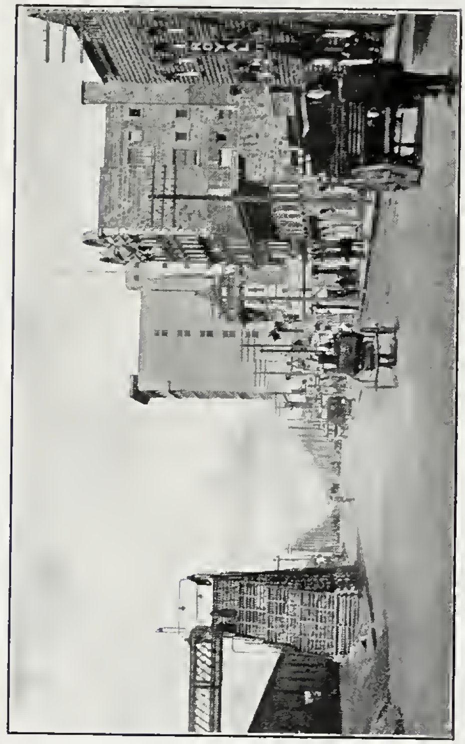
In the vicinity of the Slave and Athabaska rivers there are many salt water springs, and witnesses before a committee of the Dominion Senate reported large quantities of rock salt in the vicinity of Fort McMurray on the Athabaska river. Mr. George A. Mulloy in a report to the Forestry Branch of the Department of the Interior said: "The water of the Salt river, a tributary of the Athabaska, is very salty. About ten miles from its mouth a district called the Salt Country is reached. Everywhere in this district the sloughs and creeks are saturated with salt, and in many places where small ponds have dried up the mud is covered with a thick deposit of salt. It permeates everything. Even the leaves of the trees when chewed up taste salty. To the south and southeast a great salt plain stretches. The ground is covered by a very rich growth of grass which does not seem to be affected by the salt."

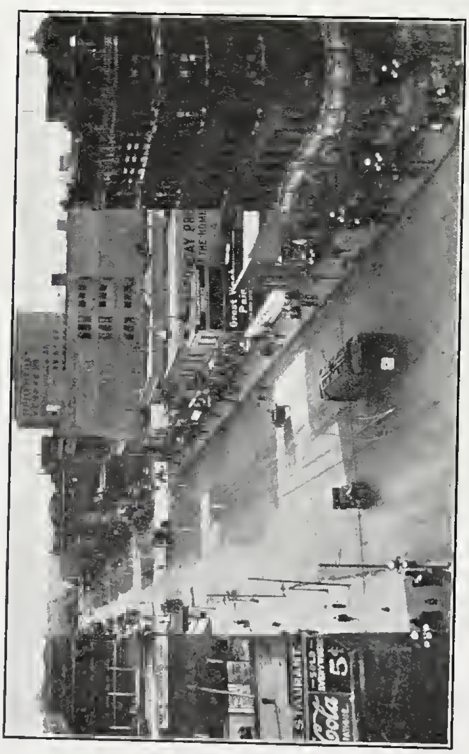
Sulphur springs and extensive deposits of sulphur are said to exist on the east side of the Athabaska river, between Fort McMurray and lake Athabaska, while on the Clearwater river there are medicinal springs with water declared to be equal to the most famous bottled mineral waters.

Sand suitable for glass-making is found in abundance along the banks of the lower Athabaska river.

THE TAR SANDS OF THE ATHABASKA.

In a district extending on both sides of the lower Athabaska river there are immense deposits of sand saturated with tar, which are supposed to have been produced by petroleum welling up from the underlying limestones. Dr. Robert Bell, of the Canadian Geological Survey, says: "At a temperature of 60 degrees Fahr. the mass is sufficiently plastic to bend





Street scenes, Saskatoon, Saskatchewan

considerably before breaking. When cut with a knife the shavings or chips curl up like those of hard soap. When worked in the hand it becomes softened and may be moulded like putty and is quite brittle. In a fire of wood it soon ignites, burning for some time with a smoky flame and then falling to powder." Mr. Wyatt Malcolm, reporting to the Geological Survey, says of these tar sands: "The supply is almost inexhaustible. The beds vary in thickness from 140 to 220 feet, and although they have not been fully explored it has been estimated that they have a distribution of at least 1,000 square miles." Mr. R. G. McConnell, in a report to the Geological Survey, after describing these tar sands as of enormous extent, says: "The commercial value of the tar sands themselves as exposed at the surface is at present uncertain, but the abundance of the material and the high percentage of bitumen which it contains make it probable that it may in future be utilized for various purposes. Among the uses to which it is adapted may be mentioned roofing, paving, insulating electric wires, and it might also be mixed with lignite which occurs in the neighbourhood and pressed into briquettes for fuel." Dr. R. W. Ells, in a report to the Geological Survey, and other authorities have expressed the opinion that oil could be recovered from the tar sands by distillation. However, the wide interest that has been taken in these famous tar sands has been due to the belief that there must be immense quantities of petroleum somewhere beneath them, but whether these expectations will be realized or not remains to be seen. Several wells have been drilled without results.

PETROLEUM IN ALBERTA.

There are petroleum springs at several points in Great Slave lake near the shore. The oil comes up to the surface of the water. At various points along the Peace river there are indications of oil. Geologists say that the prospects of finding large quantities of oil in northern Alberta are very good. In the Pincher creek district in southern Alberta southwest of the town of Macleod oil has been struck in several places and it is claimed that a great oil field exists there, but the production of oil has been small up to the present time. A few miles south of the city of Calgary a light oil about 90 per cent gasoline has been struck; a number of wells are being bored and great expectations have been aroused.

NATURAL GAS IN THE PRAIRIE PROVINCES.

In drilling for oil near the mouth of the Pelican river, a tributary of the Athabaska, such a heavy flow of gas was struck at a depth of 820 feet that the roaring of it could be heard three miles away, and the work of drilling for oil had to be abandoned. Natural gas springs have been found at a number of points on the Peace and Athabaska rivers. There is a productive gas well near Wetaskiwin about 40 miles south of Edmonton and gas is reported to have been struck at Tofield on the Grand Trunk Pacific railway. In southern Alberta there are productive gas wells at a number of points in a wide district of which the city of Medicine Hat is the centre. In Medicine Hat itself the wells yield large quantities of gas supplying the town with light and fuel both for domestic and industrial purposes. At Bow island, 40 miles west of Medicine Hat, there are a number of productive wells from which gas is piped to Calgary, Lethbridge and other towns.

High street, Moose Jaw, Saskatchewan.

Main street, Moose Jaw, Saskatchewan.

Geologists say that there are possibilities of finding natural gas at many points in Saskatchewan and Manitoba by deep drilling.

THE FORESTS OF THE PRAIRIE PROVINCES.

The forest belt of the Western Plain has often been swept by fire owing to the carelessness of Indians and traders, and consequently only a small proportion of the trees are very old. It is only in places where trees have escaped the ravages of fire that an idea can be formed of the possibilities of growth. It is the general opinion of explorers that if there had never been any fires the greater part of the forest belt would be covered with good sized trees. There are enormous quantities of timber large enough for pulpwood or for fuel, but comparatively small quantities large enough for saw-mill purposes. The dominating trees are spruce and jack pine, but there are also considerable quantities of tamarack, poplar and birch.

Rev. John Semmens, a missionary who spent some time in the Burntwood River district northeast of lake Winnipeg, wrote regarding the timber: "I have cut timber as large as two feet in diameter at the butt and fifty feet in height, but this is exceptional. From ten to fifteen inches near the ground is a better estimate of the average size of the trees." The Venerable Archdeacon McKay, who as a missionary travelled extensively in northern Saskatchewan, stated before a committee of the Dominion Senate that he had a saw-mill operated by water-power at lake La Ronge, and that the logs averaged seventeen to the thousand feet. The logs were fourteen or fifteen feet long and about two feet in diameter at the butt. He said such timber was scattered all over the country from the North Saskatchewan river to the northern boundary of the province wherever the forests had not been ravaged by fire. This good timber sometimes extended for miles. Sir George Simpson, the famous explorer, camped one night in the valley of the Clearwater river under a tree which he described as measuring three yards in girth at five feet from the ground. Mr. Fred. S. Lawrence gave evidence before a Committee of the Dominion Senate that in the valley of the Peace river he had seen many spruce trees three feet in diameter and had measured one four feet four inches in diameter which carried its trunk well up clear of branches for forty or fifty feet. He said cottonwood trees four feet in diameter and poplar trees two feet in diameter were often seen. But these examples must be taken merely as representing the possibilities of tree growth under favourable conditions in localities not ravaged by fires.

That part of southern Manitoba lying between the lake of the Woods and lake Winnipeg is largely covered with forests. West of the Red river in southern Manitoba there are several hill districts locally called "mountains," that were well-wooded when the settlement of the prairies began and although a great deal of the timber has been cut and fires have done some damage they still have a considerable quantity of standing timber. They have all been set aside as Government forest reserves. There is also a swamp forest reserve. These Government forestry reserves have been described as follows by Mr. R. H. Campbell, Dominion Director of Forestry: "Turtle Mountain Forest Reserve lies along the International boundary and has an area of 69,920 acres elevated from 200 to 600 feet above the surrounding prairie. Spruce Woods Forest reserve is an area of sandy land 143,680 acres in extent which is traversed by a tamarack swamp. The Riding

Calgary, Alberta, street scene.

Calgary, Alberta, street scene.

Mountain Forest reserve, comprising 982,400 acres, the Duck Mountain Forest reserve, comprising 987,680 acres, and the Porcupine Forest reserve, comprising 759,040 acres—a total of 2,729,120 acres—are tracts of land rising from 300 to 1,000 feet above the surrounding plains and their general character is the same. The timber consists of spruce, jack pine and tamarack on the upper plateau. Poplar with considerable white birch covers most of the lower plateau, and there is scattered in the coulées a growth of elm, oak, ash and poplar."

Mr. Campbell believes that by careful conservation these forest reserves may be made of great value. He says: "The investigations we have made of the rate of growth of timber in the province of Manitoba compare favourably with the rates of growth in European countries, such as Germany, France, and Sweden, where forestry is being practiced profitably. The rotation or the period required for maturing a crop of trees from seed in Germany is with spruce and pine from 60 to 80 years. In Sweden the rotation is 60 to 80 years for pulpwood and 100 to 120 years for lumber. The investigations of rates of growth of spruce and pine so far as they have been carried out here indicate that on ordinary well drained soil the period of rotation might be within similar limits. The annual rate of production of timber in a European forest is from 250 feet board measure per acre up to as high as 1,000 feet board measure. If only a production of 100 feet board measure per annum were reached in the present Riding Mountain, Duck Mountain, and Porcupine Hills reserves in Manitoba, the aggregate area of which is 2,415,840 acres, it would mean an annual cut of 241,584,000 feet board measure, a cut equal to that of Manitoba, Saskatchewan and Alberta at the present time."

In southern Manitoba in the river valleys there are a few elm, oak, basswood and white cedar trees of fair size.

In southern Alberta near the British Columbia boundary the Douglas fir grows well.

In the year 1913 fifty saw-mills in Manitoba cut 64,617,000 feet of spruce, 2,783,000 feet of jack pine, 2,172,000 feet of tamarack, 2,066,000 feet of aspen poplar, 268,000 feet of balsam poplar, 27,000 feet of birch, 26,000 feet of oak, 1,000 feet of cedar and 1,000 feet of elm. In Saskatchewan twenty-five saw-mills cut 112,750,000 feet of spruce, 1,813,000 feet of tamarack, 206,000 feet of jack pine, and 31,000 feet of aspen poplar. In Alberta forty saw-mills cut 41,704,000 feet of spruce, 2,237,000 feet of jack pine, 291,000 feet of Douglas fir, 76,000 feet of tamarack, 70,000 feet of balsam poplar, 59,000 feet of aspen poplar, 25,000 feet of birch.

WONDERFUL GROWTH OF CITIES OF THE PLAIN.

Winnipeg, the capital of Manitoba, situated at the confluence of the Red and Assiniboine rivers, claims the title "Gateway City of the Western Plain." Every railway connecting the eastern and western provinces passes through Winnipeg and all the great railway lines have made it their western headquarters. It is now the world's greatest primary grain market, handling more grain than the largest grain centres of the United States. It has always been the chief wholesale distributing centre of the Prairie Provinces, and since cheap electric power has been secured from the Winnipeg river it has become an important manufacturing centre. There are now over 400 factories employing over 20,000 hands, and the

First Avenue, Edmonton, Alberta.

Jasper avenue, Edmonton.

annual output of manufactured goods is valued at over fifty million dollars. The remarkable advantages which Winnipeg enjoys in the possession of cheap electric power will be explained more fully in the chapter on hydro-electric power in Canada. As regards rapid growth, Winnipeg is one of the world's marvels. The population was 241 in the year 1871, 42,340 in 1901, and 136,035 in 1911, while in the spring of 1915 it was estimated to be 212,000, and including St. Boniface and other suburbs, 273,000. In the ten years ending with 1914 the value of buildings constructed in Winnipeg was $128,264,595, an annual average of $12,826,459. In the year 1900 the Winnipeg electric street railway carried 3,002,538 passengers; in the year 1914 it carried 58,489,987 passengers. Brandon, on the Assiniboine river, 133 miles west of Winnipeg by railway, is the second city of Manitoba, and is likely to become an important manufacturing and distributing centre owing to its central situation in the province of Manitoba and its excellent railway facilities with the Canadian Pacific, the Canadian Northern, the Grand Trunk Pacific and the Great Northern railways tributary to it and a number of branch lines radiating into the rich farming country that surrounds it. Brandon is noted for its two great annual exhibitions, known as the Interprovincial Summer Fair and the Brandon Winter Fair and Live Stock Show, which attract visitors from all parts of Western Canada. It has devoted more attention to tree culture than any other city of the western plain and all visitors are impressed with its homelike appearance. Brandon's population was 13,839 at the census of 1911, and is now estimated to be about 18,000. Portage la Prairie, 56 miles west of Winnipeg, is also an important railway centre. Its population was 5,892 according to the census of 1911. The Pas, the starting point of the Government Hudson Bay railway, and Port Nelson, its terminus, may become important towns in the future.

Regina, the capital of Saskatchewan, first appears in the census returns in 1901 with a population of 2,249; in 1911 the population was 30,213, and in 1914 it was estimated to be 45,000. The city of Moosejaw, Saskatchewan, had a population of 1,558 in 1901; in 1911 the population was 13,823, and it was estimated to be 23,000 in 1914. Saskatoon, another Saskatchewan city, has had a phenomenal growth; the populatiton was 113 in 1901 and 12,004 in 1911, while it was estimated to be 25,000 in 1914. Prince Albert, at the meeting place of the North Saskatchewan and South Saskatchewan rivers, had a population of 1,785 in 1901 and 6,254 in 1911; it was estimated to be about 10,000 in 1914.

Calgary, Alberta, had a population of 4,392 in 1901; in 1911 the population was 43,704 and in 1914 it was estimated to be 75,000. Edmonton, the capital of Alberta, had a population of 2,626 in 1901; in 1911 the population was 24,900, and in 1914 it was estimated to be 59,339. Medicine Hat, in southern Alberta, had a population of 1,570 in 1901 and 5,608 in 1911, while it was estimated to be 12,000 in 1914. Lethbridge, in southern Alberta, had a population of 2,072 in 1901 and 8,050 in 1911, and it has grown rapidly since the census. Many other small towns and villages have sprung up from the vacant prairies within the last ten years.

In thinking of the future possibilities of the prairie cities, the vast extent of the country tributary to them and the number of large cities that exist in Europe and even in the United States within an equal area must be taken into consideration.

Chapter XI.

THE NORTHWEST TERRITORIES.

In the settled parts of Ontario and Quebec old settlers say that many districts in which summer frosts are never experienced now were formerly quite liable to summer frosts, and they attribute the change to improved drainage. In districts of southern Manitoba, where the early settlers often lost their crops through summer frosts, no such trouble is now experienced. In these Manitoba districts the lands did not require drainage, but many farmers believe that the general cultivation of the soil by opening it up to the sun and the air warms it. They say that the cultivated soil receives and stores heat during the long, hot summer days, and in the cool nights the heat radiates from the soil, thus preventing blighting frosts. There is very little doubt that when the sections of Ontario and Quebec lying between the Height of Land and James bay and on the east and west sides of James bay and the northern half of Manitoba, Saskatchewan and Alberta have been thoroughly drained and brought under cultivation there will be a great improvement in climatic conditions so far as they affect agriculture. This is true also of a large portion of the Northwest Territories which lie to the north of the 60th parallel of latitude. In fact at some of the Hudson's Bay Company posts in these territories the clearing, draining and cultivation of land has already had a remarkable effect, and if this is true where very small areas have been brought under cultivation it is conceivable that the cultivation of wide areas might have a very great influence in preventing summer frosts. If well cultivated soil does receive and store the sun's heat it seems reasonable to suppose that in these northern districts where the summer days are so long the general opening of the soil to the sun and the air should have a marked effect.

THE HOURS OF SUNLIGHT.

Mr. William Ogilvie in a report on the Mackenzie River valley made an interesting comparison between the hours of sunlight from the 1st of May to the 31st of August at Hudson's Bay Company posts on the lower Mackenzie river in the Northwest Territories and at the city of Ottawa.

Mr. Ogilvie points out that if the hours of sunlight were reduced to days of twenty-four hours at each place, Ottawa would have seventy-five days and five hours of full sunlight; Fort Simpson, eighty-nine days, eleven hours; Fort Good Hope, ninety-nine days, twenty-two hours; and Fort McPherson, one hundred and nine days, twenty-one hours during the four months.

Following is the comparison of the number of hours of sunlight:—

Latitude.	Ottawa 45° 26′	Simpson 61° 52′	Good Hope. 66° 16′	McPherson 67° 26′
Hours Sunlight.	H. M.	H. M.	H. M.	H. M.
May 1	14 08	16 05	17 06	17 30
June 1	15 16	18 39	21 04	24 00
June 21	15 30	19 14	22 48	24 00
July 1	15 24	19 02	22 04	24 00
August 1	14 32	16 56	18 16	19 24
August 31	13 08	14 08	14 36	14 44
Hours Sunlight.	Hours.	Hours.	Hours.	Hours.
May	456	538	592	706
June	462	570	662	720
July	464	558	625	684
August	423	481	519	527
Totals	1805	2147	2398	2637

"Everywhere the Mackenzie basin is quite as capable, so far as quality of soil is concerned, of supporting an agricultural population as the greater part of the provinces of Ontario and Quebec," wrote Mr. Ogilvie in 1888 before Ontario and Quebec provinces had been extended northward. "The soil, as seen from the river, is generally good, and the probability is that it continues so at least as far back from the stream as the woods extend. This extent is said to vary from twenty to forty miles on the east side, where no stream flows in, but where there are streams the distance is much greater, as the timber follows the valleys. Beyond the fringe of timber we come to the so-called barren lands, on which nothing but mosses and lichens grow and which, except as the pasturage of the musk-ox and a few other animals, are practically useless, so far as known at present. On the west side of the river the woods extend to the timber line on the mountains. Assuming the limits to be as above, the area of the fertile soil can readily be found. Speaking only of that portion of Mackenzie basin extending from Athabaska lake to the Arctic ocean, we have a strip of land nine hundred and forty miles long and something over sixty wide. This gives in round numbers sixty thousand square miles of land, the agricultural capabilities of which we may reasonably discuss. I think the above area is less than that actually wooded, but on the west side much of the surface is probably at such an elevation, being near the mountains, as to be outside the limits of our discussion. Theoretically, the points involved are the prevalent temperatures during the growing months, the period of vegetation and the duration of sunshine." Mr. Ogilvie stated that when he was at Wrigley, latitude 63° N., on August 15, the people were gathering blueberries, then fully ripe and as large and well flavoured as they are in Old Ontario. Ripe strawberries were found on August 9 ninety miles below this, and raspberries soon afterward. Above Fort Wrigley wild gooseberries and both red and black currants were found in abundance, some of the small islands being literally covered with the bushes. The gooseberries were large and well flavoured and the currants compared favourably with the same fruit as cultivated in the vicinity of Ottawa, the black currants being especially large and mellow.

COMPARED WITH FINLAND.

Mr. Ogilvie compared the Mackenzie River basin north of the 60th parellel of latitude with Finland, lying between 60° and 70° north latitude, with an area of 144,254 square miles and with a population of over two millions. He compared it also with the Russian province of Vologda, having an area of 145,265 square miles and a population of about 1,600,000. He said: "The province of Vologda lies between latitudes 58° and 65°. It is about 750 miles in greatest length and three hundred miles greatest width. It is drained by the Dwina river chiefly. Its products are carried by this river to Archangel and exported thence in vessels by the White sea in the same way that we hope this northern country of ours may be served by the Mackenzie and the Arctic sea. The mouth of the Dwina is in latitude 65°, only a little south of the latitude of the mouth of the Mackenzie. The climate of the two countries is very similar. The winters are severe and the summers warm. There is no very heavy rainfall, such as we find near the coasts bordering on the Atlantic and on the Pacific. The exports from that province of Vologda are oats, rye, barley, hemp, flax and pulse. The mineral products are salt, copper, iron and marble. Horses and cattle are reared, while the skins of various wild animals, as well as pitch and turpentine, are exported." It may be noted that the great Russian city of St. Petersburg or Petrograd is in latitude N. 59° 56′ 30″, very little farther south than the boundary between the province of Alberta and the Northwest Territories.

Mr. William James McLean, who had charge of the Hudson's Bay Company post at Fort Liard for ten years, stated that he planted potatoes and barley about May 10. He reaped the barley about August 20 and potatoes were fit for use about the same time although they were generally not taken out of the ground until about September 20. Wild strawberries were ripe about the first week in July, gooseberries about the first of August, and other small fruits from the middle of July to August 10. Prof. John Macoun stated that barley ripens at Fort Simpson every year between August 12 and August 20, and that barley and potatoes were successfully grown at Fort Norman, at the mouth of Great Bear Lake river, in latitude about 65°. Prof. Macoun was of the opinion that west of the Mackenzie river nearly the whole of the country from Edmonton to the Arctic ocean has a good soil. He thought that horses, cattle, sheep and pigs would thrive in the lower Mackenzie basin and put on fat more quickly than farther south. They would have to be fed for a number of months of the year, but there would be no difficulty in growing enough to satisfy their winter requirements. The grasses were of the finest quality for pasturage. Many explorers have assumed that all the muskegs of the north are useless land, but this eminent botanist was not of that opinion. He said: "The climate of the whole northland is a stable one, and as local conditions change it will improve and where small spots are now called good land whole areas will take that term. The low altitude and the long day are fixed conditions and will always be the same. The forests will be cleared and the muskegs drained, and as the land becomes dried the frost conditions will pass away and a good country will result."

At Fort Providence, N. latitude 61° 24′, wheat has been grown for many years and has never proved a complete failure. Twenty-nine bushels

of wheat have been obtained from one bushel sown. Wheat sown on May 20 has been harvested before July 28. Fort McPherson is the most northern of the Hudson's Bay Company posts. While the summer days are very long and usually warm, severe frosts occasionally come even in midsummer, and snowstorms have sometimes been experienced in July, but the snow quickly melts and does not seem to do any harm to vegetation. It is pointed out that even in southern latitudes of the United States hailstorms are not unknown in summer. However, the climate at Fort McPherson cannot be regarded as suitable for agriculture. At Fort Good Hope, in latitude N. 66° 16′, fourteen miles south of the Arctic circle, a variety of vegetables are grown. In his book entitled "In Search of a Polar Continent," Mr. Alfred H. Harrison says: "On July 25 we arrived at Fort Good Hope. I was particularly impressed here by the gardens which I visited. They produced fine crops of nearly every kind of vegetables that we grow at home. I did not, indeed, see either peas or beans, but I noted how very fine the potatoes and cabbages were, as also the onions, beet root, lettuces and turnips. We took some of these vegetables on board and they tasted every whit as good as they looked."

FORESTS IN THE FAR NORTH.

Mr. Elihu Stewart, formerly superintendent of forestry, testified before a committee of the Dominion Senate that he thought the tree growth extended ten degrees farther north in the Mackenzie River basin than in Labrador. Aspen poplar, white poplar, balm of Gilead and birch grow as far north as Fort McPherson, in latitude 67° 26′, the natives at Fort McPherson making their canoes out of birch bark. Even in the delta of the Mackenzie, north of Fort McPherson, the islands are heavily wooded. The birch trees about the delta of the Mackenzie attain a size from 12 to 16 inches and are used at Fort McPherson in building log houses. Mr. Malcolm Macleod, testifying before a committee of the Dominion Senate in 1888, said: "As to the wood of that far north I would observe that it is remarkably hard. I have a pair of snowshoes of peculiar shape made right and left of birch for frames, like iron in texture, and though perhaps about a hundred years old, perfectly sound."

In the vicinity of Fort Confidence, at the northeast end of Bear lake within the Arctic circle, Dr. J. M. Bell found many fine specimens of trees. Sir John Franklin, who was at Fort Franklin at the southwestern end of Bear lake in 1825, said that while the trees were generally small "a few of the better grown measured from four to five feet in girth and more than fifty to fifty-five feet high." Mr. E. A. Preble, of the United States Biological Survey, explored the country surrounding Bear lake. According to his report the southern and western shores are well wooded, while the northern and eastern shores are more thinly forested, but he says the country at some distance inland is better wooded. Most of the trees seen at the south of Bear lake were spruce. In exposed situations they seldom exceeded a foot in diameter with a maximum height of forty feet, but in more favourable situations he found trees two feet in diameter. Near Fort Franklin nearly all the large trees have been cut down for building purposes and few trees over nine inches in diameter are seen. It seems to be generally agreed that in the far north the largest trees are

near the rivers. But there has been little exploration of the country at a distance from the rivers.

FISH AND GAME IN THE MACKENZIE BASIN.

All the lakes and rivers of the Mackenzie basin abound in fish. Moose, caribou, mountain sheep and a variety of fur-bearing animals are plentiful. If the modern business of fur farming were introduced in this district the value of the fur exports might reach enormous figures. Even under present conditions it is estimated that the fur shipments of the Mackenzie basin are worth between two and three million dollars annually.

THE BARREN LANDS.

The title "Barren Lands" was long ago given to the treeless country east of the watershed of the Mackenzie system of lakes and rivers and extending generally from about the 60th parallel of latitude to the Arctic ocean, although near Hudson bay the treeless lands extend a little south of the 60th parallel of latitude, while farther west and especially in the valley of the Thelon river the wooded lands extend considerably farther north than the 60th parallel. The Thelon river is described by J. W. Tyrrell as "navigable for river steamers and other boats of light draught all the way from Hudson bay to the forks of the Hanbury, a distance of 550 miles, excepting perhaps two rapids on the river above Baker lake where some improvements to the channel may be made." This river rises a little north of the 60th parallel of latitude and flows northward to considerably beyond the 64th parallel before turning eastward toward Chesterfield inlet. Mr. E. A. Preble, of the United States Biological Survey, who visited the Canadian northlands, states that a more or less continuous belt of spruce borders the Thelon river as far north as 64° 30′. The region known as the "Barren Lands" being exposed to the cold winds blowing off the ice-fields of Davis strait and Hudson strait, the season of vegetation is much shorter than in the same latitude of the Mackenzie River basin. In the short summers these lands are clothed with a wealth of flowers of many hues. At all seasons of the year they furnish sustenance for countless millions of caribou or reindeer, which never have any difficulty in getting at the rich mosses as the snowfall is light in winter. In his book, "Sport and Travel in the Northland of Canada," Mr. David Hanbury says: "No land can be called barren which bears wild flowers in profusion, numerous heaths, luxuriant grass in places up to the knee, and a variety of moss and lichens. It is barren only in the sense that it is destitute of trees, hence the name 'Dechin-u-le' (no trees), which is the Indian name for it." Other explorers have expressed the opinion that the name "Barren Lands" is a misnomer. Yet it seems to be generally agreed that outside the southern half of the valley of the Thelon river the whole region is unsuitable for agriculture, because the summer season without frost is too short to mature crops.

If the summers were long probably the greater part of the "Barren Lands" would be found suitable for agriculture, although some sections are too rocky for cultivation and would never be of value unless they contain minerals. As regards the winter climate, Mr. J. B. Tyrrell has

made a comparison of the winter temperatures of the "Barren Lands" with those of northern Siberia, and has arrived at the conclusion that no section of these lands has winters as cold as some sections of Siberia that are now inhabited. He says the mean winter temperature of the Siberian town of Yakutsk, with a population of 5,000, is lower than that of any place in the Canadian "Barren Lands." This is important, because it shows that if means of livelihood can be found for a considerable population in the Canadian "Barren Lands" the climate is not too cold for habitation. Indeed some of the explorers and traders who have wintered in the "Barren Lands" say that the steady cold and the clear, pure, dry atmosphere of the winters are very enjoyable. The remarkable claim has been made that owing to the fact that the magnetic pole is located in the Canadian northland there is something peculiarly energizing and health giving in the climate.

The question arises, if the "Barren Lands" are not suitable for agriculture are they good for anything? Have they any source of wealth likely to attract a population when the vast areas of really good agricultural land in other parts of Canada where summers are long have been occupied and brought under cultivation?

MILLIONS OF REINDEER.

First of all there are millions of caribou or reindeer. Ernest Thompson Seton, the well-known naturalist, after a trip through that country said regarding their numbers: "Cutting in half the estimates of explorers who went before me and making a most conservative estimate, there are not less than thirty millions of these caribou." Mr. J. W. Tyrrell in his book, "Across the Sub-Arctics of Canada," says that the caribou of the Canadian "Barren Lands" is the same as the reindeer of the Laplanders. These reindeer range in weight from one hundred to four hundred pounds. Mr. Tyrrell says: "As a source of venison the reindeer cannot be excelled, especially in the autumn season when it is in prime condition. During September and October the males are rolling fat, and as food their flesh is equal to the finest beef. Of all meats I have ever tasted certainly reindeer tongues take the first place for daintiness and delicacy of flavour. From the skins of the reindeer the natives of the Arctic regions make almost every article of winter clothing. For this purpose it is most admirably suited, both because of its great warmth and its remarkable lightness. Through different methods of tanning and dressing it is made adaptable to a great variety of other uses. Sewing thread, lashing twine and other strong lines are also made from sinew obtained from along the spine of this animal." As to their numbers, Mr. Tyrrell says: "There were many great bands literally covering the country over wide areas. The valleys and hillsides for miles appeared to be moving masses of reindeer. To estimate their numbers would be impossible. They could only be reckoned in acres or square miles." Could these animals be tamed or domesticated? It would seem so from the experience of Mr. J. W. Tyrrell in going among them with a camera. After describing how his party slaughtered a number of reindeer and obtained a large supply of meat, he says: "Several days were spent in drying the eighteen or twenty carcasses which were preserved, and while this work was progressing my brother and I had ample

time to roam over the hills and view and photograph the bands of deer which were still everywhere about me. After the slaughter of the first day we carried no rifles with us, but armed only with a camera walked to and fro through the herd, causing little more alarm than one would by walking through a herd of cattle in a field. The experience was delightful, one never to be forgotten." If domesticated they would furnish a livelihood for thousands of people. Great meat-packing factories could be established, and even fresh meat might be shipped out during the short season of Hudson bay navigation. A large number of people might be employed in tanning and dressing the skins, which could find a ready market both in Southern Canada and in Europe.

MUSK-OXEN IN THE "BARREN LANDS."

Musk-oxen are not so numerous in the "Barren Lands" as reindeer, but there are considerable numbers of them in some sections, especially in those parts not frequented by the Eskimos. Mr. J. W. Tyrrell says of them: "The musk-oxen are claimed as relatives both by the sheep and ox families, though they perhaps more properly represent a family by themselves. In general appearance they may be said to resemble a large brown horned sheep, but in size and weight they much more nearly resemble the ox or better still the buffalo." Mr. Murdoch McLeod, a retired Hudson's Bay Company official, has stated that a musk-ox which he helped to kill weighed fourteen hundred pounds dressed and the robe measured fifteen feet from nose to rump. The meat of the musk-ox is not so palatable as that of the reindeer, but the meat of a well-fed cow is said to be very good. The meat of the musk-ox could at least be used by fur-farmers in feeding other fur-bearing animals, and the robe of the musk-ox is valuable. The musk-ox, like the reindeer, feeds on the moss which is so common in the "Barren Lands."

FUR-FARMING IN THE "BARREN LANDS."

The people of the fertile province of Prince Edward Island have set an example in fur-farming that will be followed in the northland. There can be no doubt that all through the "Barren Lands" the climate is well suited to fur-bearing animals. The old method of hunting wild animals will be abandoned and fur-farming will become general. Thus far greater quantities of furs will be produced than formerly, and large numbers of people may find employment in feeding fur-bearing animals and preparing the skins for market.

THE FISHERIES OF THE BARREN LANDS.

The numerous lakes and rivers of the "Barren Lands," are full of fish. The fisheries of Hudson bay are also of great value. In catching, curing and packing fish large numbers of people should eventually find employment. When fur-farming becomes general, large quantities of fish will be required for feeding fur-bearing animals as well as for human consumption.

COPPER IN THE FAR NORTH.

Dr. G. M. Dawson while Director of the Canadian Geological Survey stated before a committee of the Dominion Senate in 1888 that there was

every reason to believe that the rocks along the Coppermine river were as rich in copper as those in the lake Superior district of Michigan. Mr. J. B. Tyrrell reporting on the copper possibilities of the far north, said: " The copper-bearing rocks would seem to extend along the Arctic coast, both east and west of Coppermine river for about five hundred miles in all and probably many of the smaller islands off the coast are also of the same rocks, and the total area of these rocks undoubtedly amounts to many thousands of square miles. Comparing the early accounts of the occurrence of native copper on lake Superior with the accounts which we now possess of the copper on Coppermine river, and considering the enormous extent of the northern deposits we have reasonable grounds for hope that before many years the Coppermine area will produce as much copper as is now mined in northern Michigan."

The Eskimos of the far north all have spear and arrow heads, needles, etc., beaten out of pure copper. The Eskimos who come to Fort Churchill to trade have snow-knives, ice-chisels, and fish-hooks made out of native copper. They use copper tops over their pipes while smoking and any break in their guns is usually mended with copper. From the stories they tell it would appear that there are great quantities of native copper along the Arctic coast and on the islands of the Arctic near the coast.

OTHER MINERALS IN THE REGION.

So little real exploration for any minerals has been done that it is impossible to speak very definitely of the general mineral possibilities, but geological experts of the Canadian Geological Survey have expressed the opinion that the rocks in the country back of Chesterfield are similar in character to the Huronian rocks of Ontario which have yielded such rich results in copper, nickel, silver and gold. Coal of good quality is said to exist on some of the northern islands.

A BOOK OF GREAT VALUE.

Any one who wishes to have full information regarding the Northwest Territories of Canada and the undeveloped northern regions of Manitoba, Saskatchewan and Alberta should obtain from the Railway Lands Branch of the Canadian Department of the Interior a copy of Lieut.-Col. Ernest J. Chambers book entitled " The Unexploited West," a volume of nearly four hundred large pages containing an admirable compilation of information about these northern regions.

Lake Helena and Mount Robson.

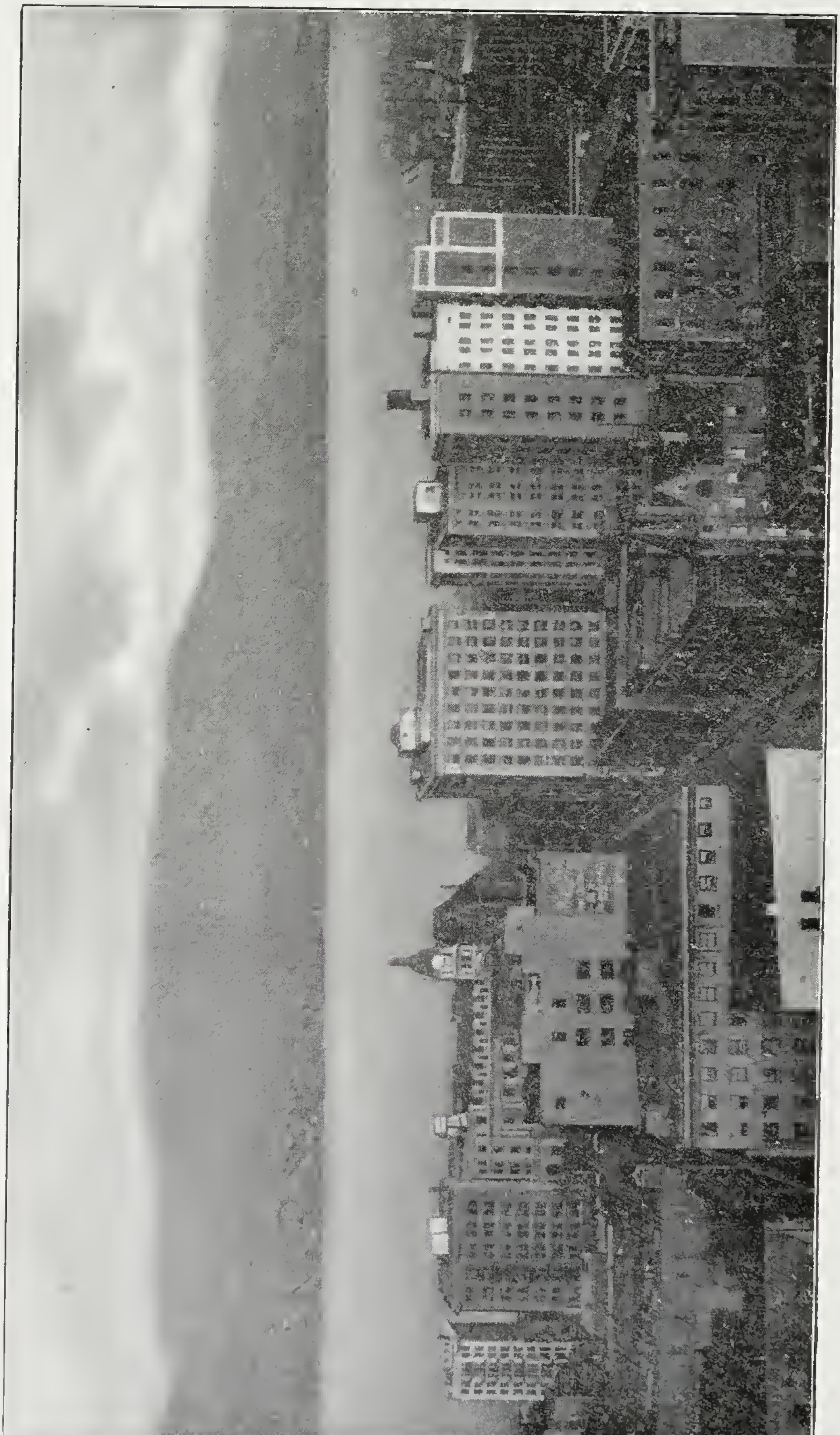
Banff Hotel, Canadian National Park.

Chapter XII.

BRITISH COLUMBIA AND THE YUKON.

The province of British Columbia is the wonderland of Canada. Within its boundaries are reproduced all the varied climates of the Dominion, and almost every natural feature, while there are some local varieties of climate and landscape that cannot be found elsewhere. Its lofty snow-capped mountains, lovely valleys, pretty lakes, and much indented coast, combine to make it most attractive to tourists, and its natural resources offer great inducements to capitalists, while for ordinary settlers with little or no capital there are endless opportunities. Extending from the Western Plain of Canada to the Pacific ocean, and from the United States boundary to the 60th parallel of latitude it is bounded on the north by the Yukon Territory of Canada. A narrow strip of the northern coast extending as far south as latitude N. 54° 57′ belongs to Alaska, and is known as the Alaskan Panhandle. The area of British Columbia is 355,855 square miles. Thirty-seven thousand square miles might be taken away from it and it would still be larger than the three Pacific coast states of the American Union, California, Oregon and Washington. British Columbia is larger than the United Kingdom, France, Belgium and Holland combined. The Yukon Territory belongs to the same geographical division of Canada as British Columbia. Combined they have an area of 562,931 square miles, and are equal to the combined area of the United Kingdom, Holland, Belgium, Switzerland, Germany, Denmark and Sweden having together a population of over 135,000,000.

There are a great number of islands off the coast of British Columbia included in the province. The most important are Vancouver island, and the Queen Charlotte islands. Vancouver island extends from latitude N. 48° 20′ to 51° N. It is 285 miles long and from 40 to 80 miles wide, having an area of about 20.000 square miles. This island forming a small part of a great Canadian province is nearly twice as large as Belgium. Queen Charlotte islands extend from latitude North 51° 55′ to latitude North 54° 8′; having an area of 3,780 square miles. Texada, Princess Royal, Pitt, Banks, Porcher, Goschen, McCauley, Hunter, Aristazable and Hawkesbury islands are of respectable size, and there are many others. The combined area of all the British Columbia islands would be great enough to make an important province even if there were no mainland. Vancouver island alone is more than nine times as large as the province of Prince Edward Island, and more than sixteen times as large as the state of Rhode Island. If Vancouver island were as densely populated as Rhode Island it would have a population of nearly nine million people. Its climate is milder than that of Rhode Island. It has large areas of good land, immense deposits of first-class coal and great quantities of good timber, while the fisheries of the surrounding waters are of great value.



Vancouver, British Columbia.

THE MOUNTAINS OF BRITISH COLUMBIA.

The Olympian mountains rise out of the ocean in Vancouver and Queen Charlotte islands, while on the mainland there are the Rockies, the Gold and the Coast ranges with long plateaus between them. The Gold range is a broken mass of mountains, known in different parts of its length as the Purcell, Selkirk, Columbia, Cariboo, Omenica, and Cassiar mountains, but the name Gold range is sometimes especially applied to the Columbia mountains. The mountains of the interior gradually slope northward and trend to the west, finally becoming merged in the Coast range so that there is a wide plateau in the northern interior. The highest peaks are near the headwaters of the Bow, North Saskatchewan and Athabaska rivers, culminating in Mount Brown with a reputed elevation of 16,000 feet.

NAVIGATION IN THE INTERIOR.

British Columbia has often been called a "sea of mountains," sometimes in patriotic admiration, sometimes in contempt. Speaking of a "sea of mountains," the thought naturally arises, can this sea be navigated? The valleys between the mountains have been called the troughs of the sea, and through these valleys flow many large rivers with numerous lake reservoirs, fed by streams from the mountains. There are many stretches of navigation, some of them hundreds of miles in length, but at certain points continuous navigation is interrupted by rapid descents and narrow canyons, through which the rivers rush.

The lakes are all long, narrow and deep, while the principal rivers are noted for their peculiar bends. Good illustrations of this peculiarity are found in the Kootenay and Columbia rivers, which run around the part of the Gold range known as the Selkirks. The Upper Kootenay river, coming down from the Rocky mountains, reaches the valley and becomes navigable just one mile away from the Upper Columbia lake. The level of the Columbia lake is ten feet lower than that of the Kootenay river, and the watershed between them is a level, gravel flat, having a gradual slope to the lake. Under such circumstances the river might be expected to flow into the lake, but instead of doing so it turns south, runs down through the valley between the Rockies and the Selkirks, crosses the international boundary, bends around the mountains, turns north again and re-entering Canada, flows up the Lower Kootenay valley between two arms of the Selkirks and terminates in the beautiful Kootenay lake, ninety miles in length. The elevation of the Lower Kootenay valley is only 1,750 feet above the sea, being about 600 feet lower than the Upper valley, and directly opposite the point where the Kootenay river should have joined the Columbia in the first place it flows out of Kootenay lake through a narrow gorge twenty-five miles in length and enters a third valley 800 feet lower down, there joining the Columbia, which has reached the same place after making a long northward bend around the Selkirk mountains. The united rivers then cross the international boundary and flow to the Pacific through American territory. In summer the Kootenay is navigable for small steamers throughout its course in the valleys, except at its southeastern bend in the United States, where there is a one mile portage to overcome rapids. From Bonner's Ferry, about ten or twelve miles south

A street corner, Vancouver, B.C.

Granville street, Vancouver, B.C.

of the international boundary, to Kootenay lake, a distance of eighty miles, the river is from six hundred to seven hundred feet wide, with an average depth of forty-five feet, and there is not a place in it where the largest ocean vessels could not float with ease.

The great bend of the Columbia is made unnavigable by canyons, but steamers run from Golden city, on the Canadian Pacific railway, to the lower Columbia lake, and a little improvement in the channel between the two lakes will enable steamers to reach the head of the Upper Columbia lake. From this point to the Kootenay river a short canal across the low watershed will ensure continuous navigation for 250 miles, and if the American Government would construct a canal one mile in length at the southern bend of the Kootenay, there would be continuous navigation for steamers from Golden city to the Kootenay lake, a distance of over 400 miles. In the Lower Columbia valley the Columbia, with its Arrow lake expansions, is navigable for many miles.

The Fraser river, rising farther north in the same plateau as the Columbia, bends around the Cariboo mountains and flows down to the Pacific between the Gold and Coast ranges. It is now navigable by large ocean vessels as far as New Westminster, fifteen miles from its mouth, and river steamers ascend as far as Yale, 110 miles from the mouth. Above Yale there are several stretches of navigation, separated from each other by narrow canyons, inclosed between precipitous mountains, through which the river rushes in foaming torrents. At God's Lock Gate the river contracts to a width of ten feet, and of course the current is of extraordinary force. There does not appear to be room between the mountains to construct canals around these torrents, and it is altogether improbable that continuous navigation can ever be secured. However, engineers employed by the Dominion Government after a careful survey estimated that in many of these canyons obstructions can be removed which will widen the channel, and that by an expenditure of $200,000 navigation for steamers can be secured from a point 110 miles above Yale to Cottonwood canyon, a distance of 210 miles. The principal tributary of the Fraser river is the Thompson, which with its lake reservoirs Kamloops and Shuswap, is navigable for many miles. Other important tributaries of the Fraser are the Stuart and Nechacko. Stuart lake, Tacla lake, Babine lake, Francais lake, Ootsabunkat lake and other lakes furnish long stretches of navigation in the central and northern interior of the province.

The Parsnip river, the upper branch of the Peace river, rises in Summit lake, near the bend of the Fraser, and there is only a short portage between it and the Fraser. Boats carrying five or six tons have been taken all the way up the Fraser, carried across the portage and floated down to the Peace river and up its tributary river, Omenica. The Parsnip and Peace rivers, although rapid streams in the mountains, are said to be navigable for stern-wheel steamers for several hundred miles before the descent to the plains is made in a series of rapids extending for about eighty miles, the total fall being about one thousand feet, after which the river flows slowly for 740 miles to the Mackenzie as already described.

There are many navigable rivers in the north, including the Skeena and Stickeen rivers, which empty into the Pacific, and a number of long ones which are tributary to the Yukon river.

As the mountains extend along the coast, the various inlets may be included in the mountain navigation. The coast navigation may best be described in the words of Lord Dufferin, who said: "Such a spectacle as its coast line presents is not to be paralleled by any country in the world. Day after day for a whole week in a vessel of nearly 2,000 tons we threaded an interminable labyrinth of watery lanes and reaches, that wound endlessly in and out of a network of islands, promontories and peninsulas for thousands of miles, unruffled by the slightest swell from the adjoining ocean, and presenting at every turn an ever-shifting combination of rock, verdure, forest, glacier and snow-capped mountain, of unrivalled grandeur and beauty. When it is remembered that this wonderful system of navigation, equally well adapted to the largest line-of-battle ship and the frailest canoe, fringes the entire seaboard of the province, and communicates at points sometimes more than one hundred miles from the coast, with a multitude of valleys stretching eastward into the interior, while at the same time it is furnished with innumerable harbours on either hand, one is lost in admiration at the facilities for intercommunication which are thus provided for the future inhabitants of this wonderful region."

So we may truthfully say that Canada's "sea-of-mountains" is navigable, but nevertheless navigation is of such a local character that the province was entirely isolated from the rest of the Dominion until the Canadian Pacific railway went through. For many years the Canadian Rockies were considered impassable, but eleven passes have now been discovered and explored, the highest being the South Kootenay, with an elevation of 7,100 feet at the international boundary, and the lowest the Peace River pass, with an altitude of 2,000 feet, in latitude 56 degrees north.

THE JAPAN CURRENT.

The warm Japan current, the Gulf stream of the Pacific ocean, has a very important influence both on the climate of British Columbia, and on the transportation problem. Bending somewhat after the fashion of British Columbia rivers which flow north and then south, the Japan current flows northward from Japan and then across the Pacific towards Alaska, on nearing which it bends south, flowing down the coast of British Columbia and gradually cooling off, so that when it reaches the state of Oregon it has become quite cold. This remarkable current flows so swiftly toward Canada that even vessels bound from Japan to San Francisco save time by following it instead of taking the direct route. This is perhaps the one exception to the rule that any two sides of a triangle are together greater than the third side. It might be supposed that ships from the Pacific ports of Canada would have this current against them in going to Japan, but owing to its northern bend the direct sailing course between Canadian ports and Japan does not lie in its way except when passing through it as it flows along the Canadian coast, so that while Canadian ships can save time by following the current in coming from Japan it does not retard them in the least when they are going the other way.

THE CLIMATE OF BRITISH COLUMBIA.

The climate of all the British Columbia islands and the coastlands is greatly affected by the warm water of the Japan current and the winds

that blow off it, so that the winters are very mild and moist. Snow seldom falls and when it does come never stays long. Soft, warm, moisture laden winds also blow up the long inlets of the sea, which extend many miles inland and along the river valleys, losing their moisture as they go inland, but retaining sufficient heat to greatly moderate the climate of the central and northern plateaus. The most northern islands and the mainland coast opposite them have a milder climate than Scotland, while the climate of the southern mainland coast and Vancouver island resembles that of the southwestern counties of England.

At New Westminster at the mouth of the Fraser river according to the meteorological records for seven years the lowest temperature in January of an average winter is 17·4°; in March, 27·6°; April, 31·3°; June, 44·9°; July and August, 45·7°; September, 41·2°; October, 29·8°; November, 25·2°; December, 18·6°. The average of all temperatures in January and February is 35·3°; March, 40°; April, 48·2°; May, 54·3°; June, 58·3°; July and August, 62°; September, 56°; October, 48·1°; November, 40·5°; December, 34·5°. The maximum temperature is 70° in April; 78·3° in May; 81·2° in June; 85·7° in July and August; 78·1° in September; 67·2° in October and 54·4° in November.

Observations for seven consecutive years showed that the rainfall in January including snow reduced to water averaged 8·16 inches; February, 7·1 inches; March, 6·27 inches; April, 2·92 inches; May, 3·49 inches; June, 2·32 inches; July, 1·78 inches; August, 1·96 inches; September, 3·44 inches; October, 5·7 inches; November, 6·95 inches; December, 9·48 inches, making a total annual precipitation of nearly 60 inches, including snow which seldom falls. This may be taken as a fair sample of the climate of the southern coast of the mainland. The southeastern portion of Vancouver island has about the same temperatures, but the rainfall is considerably less, while along the western coast of Vancouver island and all along the northern mainland coast the rainfall is much greater.

The plateau between the Gold and Coast mountain ranges has about the same annual temperature as the coast in the same latitudes, but the extremes of heat and cold are greater, while the climate is very dry. In the higher plateau between the Gold range and the Rockies the climate is colder, approximating to that on the eastern slope of the Rockies. In some parts of this plateau rain falls almost continuously in summer, and the snowfall in winter is very heavy, while in other sections of the same plateau it is comparatively dry. For example the upper valley of the Columbia near the bend has a very great rainfall, but in the vicinity of the Columbia lakes, the rainfall decreases, and the upper Kootenay valley in the same plateau has a dry climate.

British Columbia furnishes many examples of the fact that altitude has as much effect upon climate as latitude. Above an elevation of 6,000 feet in British Columbia snow falls every month of the year, so that the high peaks are always capped with snow, and magnificent glaciers can be seen at various points along the transcontinental railway lines.

NATURAL RESOURCES.

Owing to the mountainous character of the country the area of agricultural land is small in proportion to the size of the province, but there are

valleys as well as mountains and even a small proportion of so great a whole is equal to the agricultural area of some important countries. There are millions of acres of arable land, while the area suitable for pasturage is immense. British Columbia has undoubtedly the largest forests of first-class timber in North America. Almost every known mineral has been discovered in this province. Gold has been found in many of the rivers and streams and placer miners have taken out many millions of dollars worth of gold, while quartz mining is now being prosecuted on an extensive scale. Silver, copper and lead are found in large quantities in various sections while coal of high quality is widely distributed both on the mainland and on the islands and important deposits of iron ore have been discovered. The wealth of British Columbia's fisheries cannot be estimated. Salmon swarm along the coast and ascend the river in myriads, climbing over rapids and waterfalls and swimming through the torrents of the canyons, to be caught 600 miles in the interior. Black cod, herrings, halibut, sardines, anchovies, smelts, shad and oolachan abound along the coast, oysters thrive and there are many whales, while in the interior of the province sturgeon, trout, pike, perch and white fish as well as salmon are numerous in the rivers and lakes.

A MANUFACTURING PROVINCE.

The farms, the forests, the mines, and the fisheries of British Columbia will give employment to a large population, but one of the most important industries of the future will probably be manufacturing. With numerous water-powers, great supplies of coal, all the metallic minerals, and immense forests of the finest timber, no country is better suited for iron-making and wood-working industries, while the climate is especially adapted to the manufacture of textiles. It is well-known that a moist climate is most favourable to the successful manufacture of the finest grades of cotton and woollen goods, and there are many points along the coast admirably suited to textile manufacture. Immense areas of land are suitable for sheep raising. Raw cotton can be imported from the southern states, Brazil, Australia or India, and wool from New Zealand.

THE GEOGRAPHICAL SITUATION.

The geographical situation of British Columbia is most favourable for trade with all the countries of the Pacific and Indian oceans. A British manufacturing establishment with a large trade in the east by establishing a branch in Vancouver could save over 6,800 miles of carriage in shipping goods to Japan or Siberia, over 5,000 miles in shipping to Shanghai, China, over 4,000 miles in shipping to Hong Kong, about 4,900 miles in shipping to New Zealand, over 4,600 miles in shipping to Sydney, Australia and nearly 1,000 miles in shipping to Singapore.

There are first-class harbours all along the Pacific coast of Canada and the climate is so mild that none of them are ever troubled with ice at any season of the year, but to show the advantageous situation of British Columbia it will be sufficient to give the distances from Vancouver, the terminus of the Canadian Pacific railway and Prince Rupert, the terminus of

the Grand Trunk Pacific railway to some of the important trade centres compared with the distances from San Francisco, as shown in the following tables:

Miles from Vancouver.	Miles from Prince Rupert.	Miles from San Francisco.	To.
4,280	3,815	4,536	Yokohama, Japon.
4,352	3,892	4,666	Vladivostock, Russia.
(c) 5,865	(c) 5,400	6,049	Hong-Kong, China.
(a) 6,830	(a) 6,792	(b) 6,480	Sydney, Australia.
(a) 6.230	(a) 6,192	5,680	Auckland, New Zealand.
(c) 5,320	(c) 4,855	5,387	Shanghai, China.

(a) *via* Honolulu (b) *via* Fiji (c) *via* Yokohama.

BRITISH COLUMBIA FORESTS.

British Columbia is noted for the enormous size of its trees, the superior quality of its timber and the fact that it has the largest compact area of forests on the North American continent. It has often been stated that British Columbia has over 180,000,000 acres of forests, and this is perhaps not an exaggeration if trees of all sizes are included, but the report of the Royal Commission of Inquiry on Timber and Forestry of British Columbia published in 1910 stated that only a small proportion of this extensive area was covered with timber of merchantable size. It was estimated that there were in the province from two hundred and forty billion feet to three hundred billion feet of merchantable timber, probably the higher quantity. However, as trees grow rapidly in British Columbia, and the Provincial Government has adopted measures for the protection of the forests the timber not yet of merchantable size is an asset of great value. It is estimated that the annual growth of merchantable timber is much greater than the annual cut at the present time. For the year 1913 the timber cut as shown by the collection of forestry revenue by the Provincial Government was 1,457,000,000 feet board measure without including the timber used for ties in railway construction in the province. There are said to be about 425 sawmills in the province.

The forests on the islands and along the mainland coast especially in the south are very dense. One acre is said to have yielded 300,000 feet of lumber and the average yield per acre is estimated to be about 45,000 feet. These forests have probably suffered less from fires than those in any other section of North America owing to the heavy rainfall. This is one reason why so many of the trees are large although the great size must be attributed chiefly to the fact that the climate and soil are favourable to rapid growth. In some sections of the interior where the climate is dry there have been serious forest fires. Even in the southern interior the forests are much less dense than on the coast and the trees are smaller, while the northern interior is generally sparsely timbered and the trees are comparatively small.

In a country with so many varieties of climate it is manifest that there must be variation in the character of the tree growths. The most important tree of British Columbia is the Douglas fir, which takes its name

The Provincial Legislative Building, Victoria, B.C.

from an eminent botanist who explored the province in the early years of the last century. This tree is very widely distributed in southern British Columbia and extends as far east as the Bow river in Alberta. It attains its greatest size in Vancouver island, on the mainland coast opposite Vancouver island, and in river valleys near the coast, many of the trees in those districts being of great age and enormous size. The age of a full-grown tree is said to average 500 years and there are many specimens from 600 to 700 years old. The Douglas fir sometimes towers to a height of 300 feet with a diameter of 15 feet, but such trees are exceptional. However, trees 250 feet high and 10 feet in diameter are often seen and it commonly reaches a height of 180 feet with a diameter of four to five feet, the trunk being straight and clear of branches for upwards of one hundred feet. In the interior of the province the trees are not so large. The wood is of great value for structural purposes while the bark is useful in tanning. Tests made by railway engineers to ascertain the relative value of Douglas fir and oak for the building of railway cars showed that the Douglas fir would withstand a greater strain than the oak.

Next in importance to the Douglas fir is the red cedar which rivals it in size. It grows in all parts of the province, but the largest trees are found in the coast districts where the Douglas fir thrives best.

There are several varieties of spruce in the province, the most valuable being the *Picea Sitchensis* sometimes called British Columbia spruce, sometimes Menzies spruce, which thrives in the humid atmosphere of the north Pacific coast and the islands. The Engelmann spruce grows extensively in the interior.

Hemlock grows abundantly along the coast especially in the north, and in those sections of the interior where the rainfall is heavy. In Queen Charlotte islands and other islands adjacent to the northern coast the Douglas fir, so abundant in Vancouver island, does not grow, but there are large quantities of red cedar, spruce and hemlock, while the yellow cedar or yellow cypress seems to thrive better in Queen Charlotte islands than in any other part of the province. The yellow cedar resembles the red cedar in general appearance and size. It produces a wood of fine grain with a beautiful sulphur yellow colour, which is easily worked, takes a high polish and is very durable, but requires to be well seasoned before use to prevent shrinkage.

The British Columbia larch, which is very plentiful in the higher altitudes and in the northern part of the province has been described as similar in appearance to the eastern balsam, but much larger both in girth and height. It has a fine grain, is tough and durable, stains well and takes a beautiful finish. The wood of the British Columbia Broadleaf maple owing to its curly appearance when cut is in demand for panel work. There are many other varieties of trees, some of which produce good woods. Among others of commercial value are the western yellow pine, lodgepole pine and balsam fir, black cottonwood, aspen poplar, white fir, western white pine, white spruce, red alder and garry oak.

As the finest forests of British Columbia are on the islands and near the coast, while the coast is indented with numerous inlets of the sea extending far inland and receiving the waters of many rivers, the cost of

Orchards in Southern British Columbia.

Fruit farming in the Okanagan Valley, B.C.

getting out the timber is low and the facilities for shipment abroad probably unequalled. The forests of the interior are not so accessible for shipments overseas, but there will be a market in the Prairie Provinces for the timber cut by the interior mills.

The characteristics of the most important woods of British Columbia as described by the chief forester of the province will be found in Chapter XVI on Forest Products and Wood Manufactures.

FARMING IN BRITISH COLUMBIA.

The area of lands suitable for agriculture is reduced by mountains on the islands as well as on the mainland, but nevertheless there are extensive acreages of good lands in Vancouver island, Queen Charlotte islands and some of the smaller islands. The settlement of these island lands as well as those of the narrow strip of mainland territory between the Coast range and the seashore and the river valleys near the mainland coast, has been greatly retarded by the cost of clearing owing to the dense forests and the enormous size of the trees when undertaken by individual farmers. This work can be done much more cheaply when conducted on a large scale by companies having stumping machinery, and arrangements have been made to deal in this way with some extensive and well located railway lands in Vancouver island after the valuable timber has been taken off. The beautiful farms and rich gardens that may be seen near the city of Victoria on Vancouver island, and along the lower reaches of the Fraser river on the mainland, furnish good examples of the character of these lands when cleared. However some of the garden lands along the lower Fraser were recovered from the river by dyking. The moist, mild climate of the islands and the coastlands although most favourable to gardens and small fruits is not so suitable for the growth of apples and peaches as the dry belt of the interior, where these fruits are grown to perfection in the irrigated lands. The districts in Vancouver island that have been cleared and brought under cultivation bear a remarkable resemblance to the rural districts of England.

The interior valley extending from the United States boundary to the Big Bend of the Columbia river, at its junction with the Canoe river, in latitude 52 degrees north, which is drained by the Columbia and Kootenay rivers, is now generally recognized as a great fruit country. A bulletin issued by the British Columbia Department of Agriculture says of the Columbia-Kootenay valley: " This noble valley contains two-thirds more cultivatable lands and much more timber and pasture lands than Switzerland, and in addition possesses a wealth of minerals which is wholly lacking in the Swiss Republic, yet Switzerland supports a population of 3,500,000, and produces annually over two million head of live stock besides large quantities of butter, cheese, grains, fruits and vegetables."

The greater part of this valley requires irrigation to produce the best results, but as water is easily obtained from the rivers and lakes and the cups of the neighbouring hills, irrigation is not costly. Remarkable success has been achieved in fruit growing, and the acreage of fruit trees is increasing very rapidly. Fruit grown in this valley has won many gold medals at exhibitions in England, the United States and Canada. Apples, peaches and prunes of the finest quality are now extensively produced, and

Starting a farm at Lake Kathlyn in Northern British Columbia.

A wheat farm in Bulkley River Valley, Northern British Columbia.

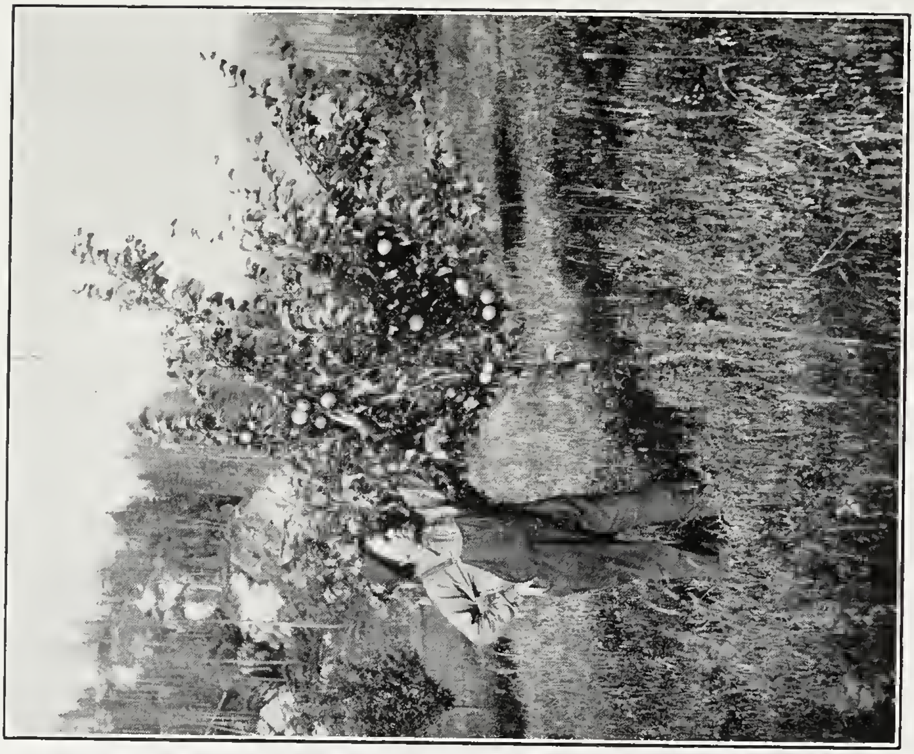
while grape growing has not been undertaken to the same extent it has been proven that the best varieties of grapes can be grown. There are a number of small rivers and lakes in this great valley, each having its own small valley with peculiar characteristics. The largest fruit-producing district at the present time is the Okanagan valley. Other districts where the fruit production is rapidly increasing are the Similkameen valley, the Kettle River valley, sometimes known as the "Boundary Country" owing to its nearness to the United States frontier, and the West Kootenay district, which includes the country surrounding the Arrow lakes, Kootenay lake and the South Columbia river. The East Kootenay district having a higher elevation is not as favourable to fruit, but the hardier varieties of apples do well.

Exploration parties sent out by the Grand Trunk Pacific Railway Company have reported very favourably on the soil and climatic conditions in the districts drained by the Upper Fraser river, the Nechacko river, Endako river, Ootsa lake and François lake, comparing these districts to southern Michigan, southern Ontario and western New York in climate, and describing them as possessing large areas of fertile soil. It is stated that the few settlers already in the valleys of the Kitsumgalum, Lakelse and Copper rivers have had great success in growing apples, pears and plums. Of the valley of the Bulkley river, a tributary of the Skeena flowing north between about 54° and 55° north latitude, it is said in the Grand Trunk Pacific report: "The climatic conditions are approximately the same as those of northern New York or eastern Ontario. The country is generally open or nearly so, and there is a continuous belt of extremely fertile land some fifteen to twenty miles wide extending from Burns lake to Moricetown, a distance of approximately eighty miles, the elevation above sea-level being from 1,350 feet to 2,300 feet. The conditions are parallel with those where the finest apples and plums are produced."

It has been noted that in the northern part of the province the mountains of the interior trend westward and join the Coast range, so that there is a broad plateau between the Rocky mountains and the Coast range, a great part of which is believed to be suitable for agriculture. The trees are comparatively small and the forest not so dense, so that the cost of clearing is not great and in some parts there are quite extensive prairies. How much of the land is suitable for cultivation is a matter of conjecture, as there has been no settlement and very little careful exploration. Prof. John Macoun estimated that there were millions of acres of land in this north country as suitable for wheat growing as the best lands of the great western plain.

It is worthy of note that while the farms of the western plain are seldom smaller than 160 acres and often much larger, the farms of British Columbia are nearly all small. Twenty acres is considered a good-sized fruit farm. Thus when all the agricultural land in the small valleys of southern and central British Columbia is occupied by gardens and fruit farms the farming population will be larger than the areas of similar size in the great western plain.

The fertile valleys of British Columbia have the advantage of sublime scenery. There are mountains in sight everywhere and many beautiful lakes and rivers. The numerous mines in the surrounding hills, the



Young apple trees in the valley of the Skeena River, Northern British Columbia.

lumber camps and the saw-mills create a fine local market, and there will always be a market in the great wheat belt to the east for the fruit not consumed in the local markets.

BRITISH COLUMBIA'S COAL FIELDS.

So large a portion of British Columbia has never been prospected that the extent of the coal deposits is not known, but the discoveries already made show that no part of the province is far distant from deposits of good coal. The following description of British Columbia's known coal measures is given by Dr. Eugene Haanel, Director of Mines, in his last report on the Economic Minerals of Canada: "In British Columbia there are three main districts in which coal mining operations are being actively pursued. These are the Crowsnest Pass region in the eastern part of the province; the Nicola Valley district, in the central part; and the east coast of Vancouver island. The Crowsnest Pass coal field is situated immediately west of the summit of the Rocky mountains, in Crowsnest pass. It is all included within the province of British Columbia, excepting a small portion in the immediate vicinity of the pass which crosses the watershed into the province of Alberta. The Crowsnest branch of the Canadian Pacific railway crosses the northern part of the coal field, and skirts its western edge for a distance of 25 miles. The rocks of the coal field are of cretaceous age. Mr. James McEvoy has made an approximate estimate of the total available coal in this field. By taking the area covered by the coal measures as being 230 square miles, and assuming a workable thickness of coal seams of 100 feet, which does not appear to be excessive, he arrives at a total quantity of 22,595,200,000 tons. The opening of the coal mines in this field marked an epoch in the development of British Columbia. Before this time the smelting industries of the Kootenays, and of Washington in the United States, had to depend, in a great measure, on coke from the coast coal mines, the transportation of which, added to a comparatively high initial cost, rendered this fuel very expensive; in fact, the cost of fuel to the smelters has since been reduced to about one-half. Immediately to the north of the Crownsnest Pass basin of coal measures, but separated from it by a belt of the underlying limestones, there is another trough of coal-bearing cretaceous rocks which extends for a distance of some 50 miles, crossing the summit of the main range, into Alberta, at the Kananaskis pass. The difficulty of access as compared with the other coal areas lying close to the railway have militated against the immediate active development of these areas; but a railway line connecting with the Canadian Pacific railway at Michel, has been located, and it is probable that before long this coal field will be exploited. That large quantities of coal exist in these measures was definitely proved in 1901, by a party of the Geological Survey, when in a section of 3,386 feet, some 12 seams were observed, varying in thickness from 8 inches to 35 feet. The southern interior of the province contains a number of coal fields of growing importance. Near Princeton, one colliery has been already opened and has made small shipments of lignitic coal; but the area of this field is great—probably nearly 50 square miles—so that there appears a certainty that several other mines will eventually be opened up. In the Tulameen valley, near

Granite creek, the Columbia Coal and Coke Company is endeavouring to open up a colliery; there are some very promising outcrops, etc., high up in Granite creek and Collins gulch, but the long tunnel which the company is driving to cut the coal at depth has not, as yet, been successful in cutting workable coal. Mr. Camsell, of the Geological Survey, estimates this basin to have an area of about five square miles. The Nicola Valley coal field is situated to the south of Nicola lake in the Kamloops district of British Columbia. Although not as extensive as the Crowsnest field, or the Vancouver island field, it is yet of great economic importance. It stands mid-way between them, hence the coal of the Nicola valley is manifestly destined to find a market in a considerable part of central British Columbia. In the northern interior there is another prospective field which attracts great interest at present, owing to its proximity to the line of the Grand Trunk Pacific railway, which is being constructed through this district. This is the Telkwa Valley field, in the northern part of British Columbia. Some of these areas are of considerable extent, and several have been proved to contain coal of good quality and in beds of workable thickness. The character of the coal varies from a bituminous to a semi-anthracite. About 140 miles by trail north from Hazelton near the head-waters of the west fork of the Skeena river, is another coal field of great promise, known as the Groundhog coal field. This coal is anthracite or semi-anthracite in character. From present indications and developments it would seem that this coal field would prove to be one of the most important developments that the province has seen for many years. The field is, as yet, only slightly developed, and, if but a fraction of its present promise is fulfilled, it is bound to have a wonderfully stimulative effect upon the future of the province. The centre of this field lies approximately in 56° 45′ north latitude, 128° 15′ west longitude. It was first discovered in 1903, though its full extent was not at that time recognized. More recent explorations have shown the field to extend in a northwesterly direction about 75 miles, and to have a width in places of about 30 miles. The rocks in which the coal occurs have been classed as of cretaceous age. Vancouver island has been the seat of a coal mining industry since 1836, which in recent years has not only supplied a local demand, but has been largely exported, to the state of California. The Vancouver island fields, now being exploited are situated on the east coast of the island. These coal measures may be naturally divided into two distinct fields, separated by a gap of 12 miles of crystalline rocks in the district of Nanoose. The northern area is the Comox field, and the southern one the Nanaimo field. Another field, until recently quite undeveloped, exists in the vicinity of Suquash, about 125 miles to the north. Seven collieries are now in operation in the district, and the production in 1913 was 927,880 tons. The coals of the various seams, although each has its own individual characteristics, are, as a whole, much alike, and furnish a bituminous coal of fair grade, the amount of fixed carbon in the best quality ranging from 50 to 60 per cent, and the percentage of ash from 5 to 10 per cent. The most striking feature of the seams is their great variability in thickness and character. The thickness varies from a few inches to over 30 feet, sometimes within a lateral distance of less than 100 feet. Coal is also found in the Queen Charlotte islands, the most important coal-bearing

area known in this group of islands being that found in a development of cretaceous rocks on Graham island, the most northerly island of the group. In this field, coal outcrops have been located in several places between the Skidegate channel and Yakoun lake in the interior of the island. In the Peace River valley extensive coal fields are located and partly prospected, but these are as yet far from transportation. Near Bear lake and river tributaries of the Fraser river near its most northerly head, and near the located line of the Grand Trunk Pacific railway, a coal area is being developed which, according to recent reports has considerable promise and, being near the railway, assumes importance."

IRON ORE AND LIMESTONE.

On the mainland of British Columbia iron ore deposits have been reported at many points, including among others Kamloops, Kitchener, Bull Run and Bermis, but no development work has been done, and there is no information available regarding the extent and character of the deposits. On both the east and west coasts of Vancouver island and on the smaller islands between Vancouver island and the mainland there are many deposits of iron ore, some of which are merely pockets, but according to a report made by Mr. Einar Lindeman, for the Mines Branch, Department of Mines, there are deposits of magnetite which appear to be of economic importance in the following localities: In the valley of the Gordon river, a few miles from Port San Juan, on the west coast; at several places in the vicinity of Barclay sound, on the west coast; at Head bay, Nootka sound, on the west coast; at Klaanch river, a few miles from Alert bay, on the northeast coast; in the vicinity of the Quinsam river, a tributary of the Campbell river which flows into the gulf of Georgia; and on Texada island between Vancouver island and the mainland. All these deposits are high in iron, very low in phosphorus and rather high in sulphur, but the sulphur could be roasted out. There are very large supplies of good limestone both on Texada island and Vancouver island, while none of these iron deposits is far distant from the coal mines of Vancouver island.

OTHER MINERALS IN BRITISH COLUMBIA.

From 1862 to 1913, inclusive, British Columbia produced 6,742,798 ounces of fine gold. The production in 1913 was 297,459 ounces of fine gold. Prior to 1890 nearly all the gold was taken out by placer miners. The Fraser river, Cariboo, Quesnel and Cassiar districts were in turn famous for their gold production. There is still quite a large production of gold from the placer and hydraulic operations in the Cariboo, Quesnel, Omineca and Atlin districts, but in recent years lode mining has been responsible for the greater part of the output. The most productive gold mine is at Hedley, in the Similkameen district. There are a number of gold mines in operation in the Nelson district, at Paulson and Long lake, on Bridge river, on Princess Royal island, Moresby island, and on Taku arm, Atlin lake. Nearly all the copper ores of the province are auriferous, and many of them contain a combination of gold, silver and copper. The output of silver in 1913 was 3,312,343 ounces, while the

Grand Trunk Pacific Dock, Prince Rupert.

Prince Rupert, British Columbia.

annual average for the ten years ending with 1913 was 2,794,151 ounces of silver. The silver of British Columbia comes chiefly from the argentiferous galena ores.

Dr. Eugene Haanel says of the silver-bearing galena ores of British Columbia: "There are a few producing mines in the Sheep Creek district, south of Nelson, but the largest number of mines are located in the Ainsworth and Slocan districts. The Sandoa-Silverton camps especially are showing promise, development at depth having been very satisfactory. The ores are argentiferous galena and tetrahedrite, with native silver and sometimes gold, argentite, zinc blende, etc., in veins cutting sediments. The ores of the Lardeau may be said to belong rather to the silver ores than to the lead, and the same may be said of the Greenwood camp. The West fork of the Kettle river will probably add some shippers to the list with the opening of traffic on the Kettle Valley railway, and the Canadian Northern railway may provide shipping facilities for the silver-lead properties of the North Thompson River valley. West of Princeton in the Similkameen, at Leadville, there are some properties, and on the coast Portland Canal district is another silver-lead producing area. Shipments have already been made from several mines in the neighbourhood of Hazelton on the Skeena river. Development has been going on quietly for several years awaiting the advent of transportation, and with better facilities shipments may be expected to increase rapidly. The lead ores of British Columbia are nearly all shipped to the smelter of the Consolidated Mining and Smelting Company at Trail, which operates in connection there with an electrolytic lead refinery, the products of which are refined gold, silver, and lead, copper sulphate and antimony. A few of the coast ores find their way to American smelters."

The quantity of lead produced in British Columbia in 1913 was 37,626,899 pounds.

Copper-bearing minerals have been found in a great many localities in British Columbia, both in the interior and on the coast and the islands along the coast. New discoveries may be expected from time to time. Dr. Eugene Haanel states that the copper-bearing minerals are usually chalcopyrite or bornite, or both. These may occur alone, but usually they are found in association with other minerals, the commonest of which are pyrrhotite, magnetite, pyrite, mispickel, and occassionally blende and galena. The principal districts in which important discoveries have been made are in southern British Columbia, in the West Kootenay and Kamloops districts and in the Coast district at a number of points along the mainland, and on Vancouver island and on some of the coastal islands. The most important active producing mines are at Rossland, at Phœnix, and at Motherlode in the interior, and at Britannia or Howe sound, Texada island, and Granby bay on the coast. In the Rossland ores gold is the most valuable constituent, the gold content varying from 0·4 ounces to about 1·5 ounces per ton, the silver from 0·3 to 2·5 ounces per ton, while the copper content runs from 0·7 per cent to about 3·5 per cent. The deposits of copper-bearing ores in the Boundary district range in size from small lenses less than 20 feet in thickness and 100 feet in length to huge ore bodies, one mine at Phœnix having a thickness of 125 feet, a known width of 900 feet and a length of about 2,500 feet. The average

ore contains from 1·2 to 1·6 per cent of copper with about one dollar in gold and silver per ton. The most important producing mines are in the vicinity of Phœnix, and at Deadwood, about four miles from Phœnix. The deposits of copper ores at Howe sound are believed to be very large, and extensive development work is in progress. They contain small quantities of gold and silver. The deposits of copper ores near Granby bay, about 110 miles from Prince Rupert, have been proven to be very important. The copper ores of the Rossland district are smelted at Trail, forming a matte containing copper, silver and gold, which is sent to the United States for refining. The copper ores of the Boundary district are smelted at Grand Forks and at Greenwood. There is also a copper smelting plant at Ladysmith, on the east side of Vancouver island, and a very large and completely equipped smelting plant recently commenced operations at Anyox, on Granby bay. British Columbia's copper production amounted to 45,791,579 pounds in 1913.

Most of the British Columbia galena ores are said to contain enough zinc blende to make its recovery a matter of great importance. In 1913 American smelting works received from British Columbia 7,074 tons of zinc concentrates, containing 5,946,727 pounds of zinc.

Discoveries of tin have been reported in several localities, but nothing very definite is known about them. Some of the British Columbia silver-lead ores contain small quantities of antimony. Discoveries of mercury have been reported at Field in the mountains and at Sechart on the west coast of Vancouver island. Small quantities of mercury were mined some years ago at the western end of Kamloops lake. Tungsten has been reported in a number of localities, but the value of the deposits is not known. Small quantities of platinum have been recovered from many of the gold placer deposits.

CITIES AND TOWNS OF BRITISH COLUMBIA.

Victoria, the capital of British Columbia, is on Vancouver island in latitude N. 48° 24′ 33″, a little farther south than Paris, which is in latitude N. 48° 50′ 13″. It is one of the most beautiful residential cities in Canada and has a delightful climate. Apart from its importance as capital of the province it has the whole island of Vancouver directly tributary to it, and when the great natural resources of the island are developed Victoria will become a great commercial centre. Its population was 31,660 in 1911 and has had a rapid growth since the census. Esquimalt, three miles from Victoria and connected with it by electric railway, is an important naval station and has a remarkably fine harbour. The city of Vancouver is not on the island of Vancouver, but is the mainland terminus of the Canadian Pacific railway. It dates its existence from the year 1885, and when the last Dominion census was taken in 1911 had a population of 100,401, while north Vancouver on the opposite side of the harbour had 8,196. Since the census the growth has been largely in the suburbs. Ocean vessels in the harbour of Vancouver are 2,895·2 miles by the Canadian Pacific railway from ocean vessels in the harbour of Montreal and 3,376·8 miles from the harbour of St. John, the Canadian Pacific Atlantic port during the winter months when St. Lawrence navigation is closed. The distance from New York to Vancouver is just 48 miles longer than from New York to San

Francisco by the shortest route and the elevations and grades on the Canadian route compare favourably with those on the American route, while the traveller bound for Asia is 286 miles nearer to Yokohama, 265 miles nearer to Vladivostock and 409 miles nearer to Hong Kong when he reaches Vancouver than he would be at San Francisco. Vancouver is in latitude N. 49° 16′ 41″. The new port of Prince Rupert, the terminus of the Grand Trunk Pacific railway, is situated on Kaien island near the mouth of the Skeena river in latitude N. 54° 16′ 30″, over five hundred miles north of Vancouver, but a little farther south than Belfast, Ireland. Prince Rupert is even nearer to Asiatic ports than Vancouver as already shown in tables, but it is 262½ miles farther by railway from the city of Winnipeg than Vancouver. The railway grades on this route are very favourable and when the resources of the central and northern portions of British Columbia and Alberta are fully developed it will become a very important city. Young as Vancouver is it is old compared with Prince Rupert, which had a population of 4,184 at the census of 1911 and has since had a rapid growth. New Westminster on the Fraser river about twelve miles from the city of Vancouver had a population of 13,199 in 1911 and is growing rapidly. Nanaimo, the Vancouver island coal town had a population of 8,306 in 1911, while Nelson in the Kootenay district had 4,476. There are a number of other small towns which promise to become important in the future.

THE YUKON TERRITORY.

The Yukon Territory became famous during the latter part of the nineteenth century owing to the great rush of gold seekers to the Klondike region. From 1885 to 1913, inclusive, the Yukon Territory produced 7,369,979 ounces of fine gold. The greatest production was in the year 1900 when 1,077,553 ounces of gold were produced. It decreased steadily after that until 1907, when the output was only 152,381 ounces. Since 1907 there has been a gradual but steady increase owing to the introduction of improved machinery, and in 1913 the output was 282,838 ounces of gold. The Yukon Territory has also been a steady producer of silver for some years past and the output in 1913 was 87,626 ounces. Extensive coal beds have been discovered and small quantities of coal have been mined for local use. There are indications of a number of other economic minerals. The area of land suitable for agriculture is not great and the summers are so short that the territory will never be important as a farming country. Yet vegetables have been grown for local use and if the mining population should ever become large considerable quantities of vegetables might be grown in the long days of the short summers. Raspberries, black and red currants and cranberries grow wild in abundance. There is a good deal of timber suitable for firewood, but very little large enough for building or manufacturing. It is a fine game country, moose, caribou and mountain sheep being numerous, while there are a large number of fur animals.

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Piles of dried fish.

Smoking fish at Digby, Nova Scotia.

Chapter XIII.

THE FISHERIES OF CANADA.

Nature has endowed Canada with most extensive fisheries. The long coast line and the numerous bays, inlets and harbours on the Atlantic and Pacific oceans, the gulf of St. Lawrence, the bay of Fundy, Hudson bay and the Pacific ocean, as well as the great rivers and multitudinous lakes, both large and small, in the interior of the country have already been referred to. The coast line on the Arctic ocean need not be considered, as it is uncertain to what extent its waters can be utilized by fishermen, although there is a possibility that important sea fisheries may eventually develop directly north of the mouth of the Mackenzie, a part of the Arctic which is even now frequented by whaling vessels coming from Behring sea.

The temperature of Canadian waters is favourable to the production of fish of fine flavour and good keeping qualities, while the extraordinary number of inlets, bays and harbours along the coasts not only make feeding and breeding grounds for countless millions of fish, but afford convenient havens for fishing vessels, so that catches of fish can be quickly prepared for market, and whether fish are to be sold fresh or preserved by drying, smoking, pickling or canning, it must be evident that they are in better condition for human food when prepared and packed soon after being caught than if they must be transported long distances by the fishing vessels.

Mr. J. J. Cowie, of the Department of Marine and Fisheries, has explained one of the advantages of in-shore fisheries as compared with deep-sea fisheries at a distance from the fishing settlements as follows: "Cod that is split on board of a deep-sea vessel is heavily salted in order to preserve it during the fishing voyage, which sometimes lasts a couple of months, and being so thoroughly impregnated with salt it does not make good dried fish, but is apt to become slimy when transported to hot climates. On the other hand in-shore fish are landed daily, split and placed in salt for a short time only, then dried. The curing is, therefore, due less to the salt than to the action of the sun and air, so that fish cured in this manner may be safely exported to hot climates and stored there without deteriorating."

Canada employs eight men in the in-shore fisheries for one employed in the deep-sea fisheries, but even the Canadian deep-sea fishermen have an advantage over Americans fishing in the same waters, because the Canadian home harbours are much nearer to the deep-sea fisheries.

SUPPLIES OF BAIT.

Nothing is more essential to successful fishing than convenient supplies of bait, and in securing bait the great number of bays along the coast

is of immemnse advantage to Canadian fishermen. One class of fishermen catch bait which they sell to other fishermen. During the cod-fishing season on the Atlantic seaboard the Canadian Department of Marine and Fisheries provides a system of daily telegraphic bait reports. Bulletins are posted up at a number of ports and published in all the daily papers, notifying masters of fishing vessels from day to day where bait supplies are obtainable, so that instead of hunting for bait they know just where to go for it, and a fleet of fishing vessels will often dispatch one vessel to buy bait enough for a number, so that fishing can go on without interruption. This telegraphic service is giving great satisfaction.

CONSERVATION OF FISHERIES.

The word "inexhaustible" was at one time greatly overworked in Canada. The people were told so frequently that they had inexhaustible fisheries, inexhaustible forests, inexhaustible minerals and soil of inexhaustible fertility that wasteful methods were encouraged, but in recent years the various departments of the Canadian Government have inaugurated campaigns of education regarding the importance of conserving the natural resources of the country. The Fisheries Branch of the Department of Marine and Fisheries is doing excellent educational work, and not only have regulations been made to protect the fisheries against wasteful methods of fishing but a number of fish hatcheries have been established, with most gratifying results. During the fiscal year 1914 there were distributed from these hatcheries 713,910,304 lobsters, 285,990,000 whitefish, 117,155,900 Pacific salmon, 19,851,830 Atlantic salmon, 25,707,585 salmon trout, 1,721,010 speckled trout, 1,025,500 shad, and small quantities of other fish. The placing of these fry in the waters has a remarkable effect in preventing depletion of the suppply of fish. This work is being extended every year and is certain to produce most important results in the conservation of the Canadian fisheries.

THE PRESENT VALUE OF THE FISHERIES.

The potential value of Canadian fisheries cannot be measured by the present annual catch, as all the fisheries experts who have studied the question are of the opinion that the Canadian fisheries industry may be very greatly expanded. According to the last report of the Fisheries Branch of the Department of Marine and Fisheries, the total value of all kinds of fish, fish products and marine animals taken by Canadian fishermen during the year ended March 31, 1914, amounted to $33,207,748, of which $29,472,811 is the value of sea fish and $3,734,937 the value of inland fish. These figures represent the value of the fish as prepared for market whether fresh, smoked, dried, canned or pickled.

The number of men engaged in fishing was 71,776, while 26,893 persons were employed on shore in canneries, freezers, fish-houses, etc. The sea fisheries gave employment to 86,486 persons on sea and shore and inland fisheries to 12,183 persons.

The following table shows the quantity and value of the chief kinds of fish landed during the fiscal year 1914:—

	Pounds.	Market value.
Salmon	155,141,100	$10,833,713
Lobsters	51,464,600	4,710,062
Cod	166,459,900	3,387,109
Herring	248,421,900	3,173,129
Halibut	25,609,600	2,036,400
Mackerel	21,544,200	1,280,319
Whitefish	13,788,700	929,962
Haddock	40,563,300	841,511
Smelts	8,872,800	810,392
Trout	7,316,400	682,619
Sardines	14,138,400	676,668
Hake and cusk	35,359,800	490,979
Pickerel	6,160,300	449,539
Pike	6,492,500	372,868
Pollack	15,009,400	187,723
Oysters	2,982,800	173,753
Clams and quahaugs . . barrels	121,335	368,325

THE WEIGHT OF FISH.

In considering Government statistics of the total catch of various kinds of fish as compared with the quantity marketed it must be noted that the weight of the fresh fish caught is greatly reduced by the processes of cleaning, drying, etc., in preparation for market. In some cases bones are removed. This is the reason why the quantities of fish marketed appear so much less than the quantities caught. For instance a fresh caught cod weighs twice as much as a green salted cod and three times as much as a dry salted cod. It takes 84 pounds of fresh salmon to produce one 48 pound case of canned salmon, while 125 pounds of fresh salmon are required to produce one hundredweight of dry-salted, 150 pounds of fresh to produce one hundredweight mild cured or one hundredweight of pickled salmon and 170 pounds of fresh to produce one hundredweight of smoked salmon. Two hundred pounds of fresh lobsters are required to produce one 48-pound case of canned lobsters. It takes 170 pounds of fresh herring to produce one hundredweight of dry salted herring, 200 pounds to produce one hundredweight of smoked herring and 300 pounds to produce one barrel of pickled herring. The term green-salted is applied to fish that have been salted but not dried. The term dry-salted is applied to fish that have been dried after being salted, but in fisheries statistics dry-salted fish are commonly referred to simply as "dried."

THE PACKING OF FISH.

The term "case" as applied to packages of canned fish in official statistics means a wooden box in which are packed one pound, half-pound and quarter-pound tins of fish, having an aggregate weight of 48 pounds. A half case is a box containing 24 pounds packed in the same way.

The standard capacity of barrels for pickled mackerel, salmon, herring and alewives is 200 pounds. A barrel with a capacity of 100 pounds is known as a half barrel. Smoked fish are usually packed in flat boxes containing 30 pounds. Dried fish are commonly shipped in wooden drums or barrels of various sizes ranging from a hundredweight of 112 pounds to

five hundredweight. Dried fish are sometimes shipped to Europe packed in bulk in the holds of sailing vessels. Green-salted fish are usually shipped in barrels of 200 pounds each.

A GOVERNMENT BRAND.

In order to encourage improved methods of packing pickled herring, alewives, mackerel and salmon, the Department of Marine and Fisheries has recently made regulations providing for Government inspection and branding. Inspection is not compulsory, but any packer wishing to have the Government brand can do so by complying with the regulations which require that the fish shall be cleaned and pickled in scrupulous accordance with official instructions and packed in barrels, half-barrels or other packages constructed in conformity with Government specifications. Inspectors are obliged to open a certain percentage of the barrels or other packages submitted for branding and carefully examine contents, the inspectors to select the ones to be opened. The Government brand is not only a guarantee of quality, but shows the grade of fish and date of packing. It is believed that these regulations will have the effect of greatly improving the quality of pickled fish as delivered to the consumer for while inspection and branding are not compulsory buyers are likely to demand fish that have passed Government inspection. The chief trouble in the past has been that barrels were often used that were not suitable for transportation to distant markets and the fish were damaged in transit.

The Government has also established a system of inspection for canning factories to ensure sanitary conditions and see that no unsound fish are canned.

SALMON FISHERIES.

The fish which ranks first in market value is the salmon. There are a number of varieties of salmon in Canadian waters. The Atlantic salmon bearing the scientific name of salmo salar, is found in the Maritime Provinces and Quebec along the Atlantic and gulf coasts and the rivers emptying into the sea. It is famous for its delicious flavour. In some of the lakes of New Brunswick there is a land locked salmon differing little from the Atlantic salmon and certain lakes of Quebec have a salmon of remarkably fine flavour known as the Onananiche. The catch of salmon was 1,798,500 pounds in New Brunswick, 1,276,100 pounds in Quebec, 940,100 pounds in Nova Scotia, and 9,000 pounds in Prince Edward Island in 1914. Nearly the whole catch of salmon in these provinces is used fresh although small quantities are smoked and dry-salted. The Canadian salmon canning industry is located in British Columbia, the quantity canned during the fiscal year 1914 being 1,400,252 cases. In addition to the quantity canned 11,830,000 pounds of British Columbia salmon were used fresh, 12,344,500 pounds dry-salted, 2,520,200 pounds mild cured and 1,352,500 pounds smoked. The salmon coming from the sea run up all the rivers of British Columbia to spawn, but the greatest runs are on the Fraser river.

British Columbia has a number of varieties of salmon. The one which is most important commercially is the Sockeye or Blueback which is known to scientists as the Oncorhynchus nerka. This is the salmon used most extensively in the British Columbia canneries as its flesh is not only of

fine flavour, but contains a large amount of oil. Other varieties canned are the Coho or Silver salmon, the Quinnat or Spring salmon and the Humpback or Pink salmon. The Quinnat or Spring salmon, which is the first to ascend the rivers, is the largest of the Pacific coast salmon. It is in great demand as a fresh fish. The Spring salmon are most plentiful in the waters around Queen Charlotte islands and the vicinity of the Skeena river. The Dog or Chum salmon is not regarded as very suitable for canning, but is excellent when fresh or salted, and large quantities of salted Dog salmon are consumed in Japan. British Columbia has 81 salmon canneries.

In the Yukon Territory 182,000 pounds of salmon were caught and used fresh in the fiscal year 1914.

LOBSTER FISHERIES.

The lobster fisheries rank next to the salmon. They are confined to the coastal waters of the Atlantic and the gulf of St. Lawrence, the catch for the fiscal year 1914 being 30,226,100 pounds in Nova Scotia, 9,289,800 pounds in Prince Edward Island, 7,817,700 pounds in New Brunswick, and 4,131,000 pounds in Quebec, a total of 51,464,600 pounds. About ten million pounds are shipped in the shell and the remainder canned.

In the course of an address before the Canadian Conservation Commission, Mr. W. A. Found, Superintendent of Fisheries, said: "The Canadian lobster fishery is and always has been the most productive lobster fishery in the world." He pointed out that there were nearly seven hundred lobster canneries, while the lobster traps numbered over a million and a half, eleven thousand men being engaged in the lobster fishing operations and eight thousand men and women employed in the lobster canneries.

THE COD FISHERIES.

The cod fisheries are of great importance. Nova Scotia marketed 26,304,000 pounds of dried, 6,067,700 pounds of green-salted, 112,800 pounds of smoked, and 5,334,500 pounds of fresh cod; New Brunswick, 6,809,400 pounds of dried, 1,238,500 pounds of green-salted, and 1,138,700 pounds of fresh cod; Prince Edward Island, 1,503,600 pounds of dried, 492,300 pounds of green-salted, and 396,900 pounds of fresh cod; Quebec, 11,247,300 pounds dried, 1,368,600 pounds green-salted, and 25,000 pounds of fresh cod. In British Columbia nearly the whole catch of cod was used fresh, only 7,800 pounds being dried and 18,100 pounds green-salted, while 2,862,400 pounds were used fresh. The British Columbia cod is slightly different from the Atlantic cod, the head being larger, while the air-bladder or "sounds" is said to be smaller.

THE HERRING FISHERIES.

New Brunswick led in the herring fisheries in the fiscal year 1914, marketing 69,177 barrels of pickled herring, 9,102,500 hundredweight of smoked, 1,332 cases of canned and 7,884,700 pounds of fresh herring, while it disposed of 72,520 barrels as bait and 126,890 barrels for use as a fertilizer. Nova Scotia marketed 49,240 barrels of pickled herrings, 1,361,100 pounds smoked, 3,604 cases canned, and 5,254,900 pounds of fresh herring, disposing of 78,149 barrels as bait and 596 barrels for use as a fertilizer.

Unloading salmon from scows, New Westminster, B.C.

Halibut catch of 30,000 pounds at Prince Rupert, B.C.

Prince Edward Island marketed 519 barrels of pickled herring and 415,100 pounds of fresh, using 39,789 barrels as bait; Quebec marketed 10,696 barrels of pickled herring, 430,000 pounds smoked, and 222,100 pounds fresh, disposing of 61,780 barrels as bait and 99,038 barrels for fertilizing purposes. British Columbia marketed 1,643 barrels of pickled herring, 793,800 pounds smoked, 31,317,800 pounds dry-salted, and 4,201,400 pounds of fresh herring.

NEW BRUNSWICK SARDINES.

There are no real sardines caught in Canadian waters, but in New Brunswick great quantities of young herring are canned and sold under the name of sardines. The quantity canned in 1914 was 85,700 forty-eight pound cases, while 124,084 barrels were sold salted or fresh for lobster bait. In the official statistics these "sardines" are not included in the herring catch but are classed separately under the name of sardines.

THE HALIBUT FISHERIES.

British Columbia ranks first in the halibut fisheries, the catch in 1914 being 22,346,500 pounds, while 3,152,100 pounds were caught by Nova Scotia's fishermen, 72,300 pounds by New Brunswick fishermen, and 38,700 pounds by those of Quebec. The whole catch of halibut appears to have been used fresh.

MACKEREL FISHERIES.

Nova Scotia marketed 8,722,900 pounds of fresh mackerel, 25,094 barrels of salted, and 443 cases of canned mackerel during the fiscal year 1914; New Brunswick, 1,705,700 pounds of fresh and 232 barrels of salted mackerel; Prince Edward Island, 297,800 pounds of fresh and 2,848 barrels of salted mackerel; Quebec, 7,500 pounds of fresh and 7,841 barrels of salted mackerel.

HADDOCK FISHERIES.

The haddock familiarly known as the "haddie" is confined to the waters of the Atlantic and the gulf of St. Lawrence. Nova Scotia marketed 13,992,900 pounds of fresh, 6,102,800 pounds of dried, 2,683,300 pounds of smoked and 6,947 cases of canned haddock; New Brunswick, 668,200 pounds of fresh, 151,600 pounds of dried, and 73,000 pounds of smoked haddock; Prince Edward Island, 20,100 pounds of fresh and 23,200 pounds of dried haddock; Quebec, 3,500 pounds of fresh and 153,600 pounds of dried haddock.

HAKE AND CUSK.

Nova Scotia marketed 1,675,500 pounds of fresh hake and cusk and 7,746,600 pounds dried; New Brunswick, 536,100 pounds fresh and 2,375,000 pounds dried; Prince Edward Island, 1,500 pounds fresh and 837,900 pounds dried; Quebec, 80,000 pounds dried.

POLLACK.

The pollack is caught in abundance along the coast of Nova Scotia and in the bay of Fundy. Nova Scotia marketed 364,900 pounds of fresh and 2,516,400 pounds of dried pollack; New Brunswick, 3,774,700 pounds of fresh and 1,103,600 pounds of dried pollack.

A FUTURE FOR CANADIAN OYSTERS.

The production of Canadian oysters is not very great at present, but there is reason to expect a great development in the oyster fisheries in a few years. Until recently no systematic measures to develop the oyster fisheries were taken, and as a result of wasteful methods the oyster beds were almost depleted. Prince Edward Island which has always been particularly noted for the fine quality of its oysters, is leading the way in oyster development. All the areas in which there are live oyster beds and all those areas in which it is believed oysters could be successfully raised have recently been surveyed by the Government and it is proposed to lease these areas under strict regulations to ensure their development. Small areas will be set aside for individuals and large areas for companies and it is expected that in a few years a very important oyster industry will be developed. Dr. Joseph Stafford of McGill University who has made a special study of oysters and is regarded as the highest Canadian authority on oyster culture states that the Canadian oyster is superior to any other. After referring to the high reputation of the flavour of the Canadian oysters as compared with United States oysters Dr. Stafford says: "Our Canadian oysters took first place at the International Exposition at Paris some years ago. They had to be collected from various places in the Maritime Provinces and during that time they were standing in barrels on wharves, sometimes in the hot sun. After having been subjected to that treatment they had to be transported across the Atlantic and placed on wharves there until the exhibit could be arranged and yet when placed in competition with European oysters, that had been taken from the water only the day before, they were awarded first place. So, there must be something in their ability to withstand rough usage and change of climate. Oysters, as well as fish that are taken out of cold waters can stand transhipment and retain their flavour better than those taken out of warm waters."

Dr. Stafford recently made important discoveries which may have an important influence on oyster culture not only in Canada, but in other countries. Previous to the investigations of Dr. Stafford there was a period of about three weeks in the life of the young oyster that was not known and this lack of knowledge made it difficult to catch spat at the right time.

When the oyster spat reaches a certain stage of development it sinks to the bottom and fastens itself to stones, shells or any other solid thing to which it can get attached and the success of oyster culture largely depends upon knowing the right time to place shells or other contrivances to catch the spat. Dr. Stafford has discovered the development of the oyster in all its stages and he says that any one properly instructed can tell almost to a day when is the proper time to plant shells. The importance of this may be judged from a statement of Winslow, the well-known American expert, who said some years ago that hundreds of thousands of dollars would be saved annually to the Connecticut oystermen if they had any reliable method of determining with any approximate accuracy the date when the attachment of the young oyster would occur.

For the fiscal year 1914 Prince Edward Island produced 12,551 barrels of oysters, New Brunswick 10,800 barrels, Nova Scotia 3,397 barrels and

British Columbia 2,680 barrels. The British Columbia oyster is very small, never exceeding two inches in length, while the Prince Edward Island oysters often reach a length of seven or eight inches and they have been known to reach a length of fifteen inches. The Atlantic and Pacific oysters are distinct species and cannot inter-breed. However, some Prince Edward Island oysters were transplanted on the coast of southern British Columbia several years ago. They appear to be breeding and doing well, but the results are not yet definitely known.

CLAMS AND QUAHAUGS.

At present clams and quahaugs make a greater showing in the fisheries statistics than oysters. Nova Scotia marketed 27,913 barrels fresh and 175 cases canned; New Brunswick 38,070 barrels fresh and 18,530 cases canned; Prince Edward Island 18,671 barrels fresh and 290 cases canned; British Columbia 9,239 barrels fresh and 7,328 cases canned during the fiscal year 1914. The scallop, a delicious shellfish, is taken in great quantities at the Tancook islands in Chester bay, Nova Scotia.

OTHER SEA FISH.

Among other sea fish caught in considerable quantities are alewives, smelts, shad, tomcod, and flounders. Alewives are found only on the Atlantic coast, but shad, smelts, tomcod, and flounders are caught on both the Atlantic and Pacific coasts. The common sturgeon is caught along the Atlantic coast and in the St. Lawrence river and its tributaries. The striped bass is fond of brackish water and ascends the New Brunswick rivers to spawn.

FRESHWATER FISH.

In Ontario and Quebec there is a lake herring known as the cisco. It is particularly abundant in lake Erie. The catch of cisco in the province of Ontario during the fiscal year 1914 amounted to 13,071,800 pounds with a market value of $658,038.

The whitefish is the finest of freshwater fish. It is found in the lakes and rivers of New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, the Northwest Territories and the Yukon Territory. Sir John Richardson, the Arctic explorer who lived in the Northwest Territories for a considerable time with no other food than the whitefish, which is abundant in all the northern lakes and rivers wrote regarding this fish: "Though it is a rich, fat fish, instead of producing satiety it becomes daily more agreeable to the palate and I know from experience that deprived of bread and vegetables one may live wholly upon this fish for months or even years without tiring."

The whitefish catch of the province of Ontario for the fiscal year was 6,220,400 pounds; Quebec caught 51,400 pounds; New Brunswick 2,600 pounds; Manitoba 3,824,300 pounds; Saskatchewan 3,099,300 pounds; Alberta 1,401,200 pounds; and the Yukon Territory 8,360 pounds. The whitefish does not like very deep water and in lake Superior which is generally very deep it is seldom caught except in the shallow places. It is most abundant in lake Erie.

Canada has both sea trout and freshwater trout, but the greater part of the trout catch was in fresh water during the year 1914, Ontario accounting for 5,226,300 pounds, Manitoba for 150,500 pounds, Saskatchewan 38,800 pounds, Alberta 242,800 pounds, and the Yukon 27,100 pounds. Quebec caught 71,000 pounds of sea trout and 96,700 pounds lake trout; New Brunswick, 211,500 pounds sea trout and 72,800 pounds lake trout, while Prince Edward Island caught 12,200 pounds sea trout and British Columbia 65,000 pounds. The two most widely distributed varieties of freshwater trout are the salmon trout or lake trout, and the speckled or brook trout. In certain lakes of Quebec there is a variety of trout known as the Red Canadian trout. The Ontario catch of pickerel was 2,656,400 pounds, and of pike, 3,454,700 pounds. Manitoba caught

Lake Superior Trout and Whitefish

3,102,400 pounds of pickerel and 1,875,600 pounds of pike; Saskatchewan, 171,000 pounds of pickerel and 793,600 pounds of pike; Alberta, 51,300 pounds of pickerel and 274,900 pounds of pike; Quebec, 122,900 pounds of pickerel and 93,500 pounds of pike; New Brunswick, 52,800 pounds of pickerel. Ontario's catch of perch was 1,242,700 pounds, and of carp, 672,100 pounds. Quebec's catch of perch was 182,300 pounds, and that of Manitoba, 24,300 pounds. In Manitoba, Saskatchewan and Alberta, 1,441,900 pounds of tullibee were caught and in Ontario, 573,800 pounds; Ontario caught 526,400 pounds of catfish, Manitoba 64,800 pounds and Quebec 19,700 pounds. Manitoba fishermen caught 508,900 pounds of goldeyes. The catch of sturgeon was 253,500 pounds in Ontario, while

97,700 pounds of sturgeon were caught in the lakes of Quebec and 7,000 pounds in the lakes of New Brunswick. There are several varieties of bass in the inland lakes and rivers and a number of other freshwater fish are caught by sportsmen.

In Manitoba, Saskatchewan and Alberta the fishing is usually done in the winter after the lakes are frozen over. At that time of the year the farmers have time to spare and much of the fishing is done by them. Holes are cut in the ice.

The freshwater fish are generally used fresh or frozen; most of them are consumed in the home market, although some shipments are made to the United States.

FISHERIES OF HUDSON BAY AND JAMES BAY.

The fisheries of Hudson bay and James bay have never been exploited, but the construction of the Government railway from the Pas to Port Nelson and the proposed extension of the Ontario Government railway to James bay may bring about the development of these fisheries. An investigation of the possibilities of James bay was recently made by the Fisheries Branch of the Department of Marine and Fisheries. Many kinds of food fish were found in great abundance both in the bay and the rivers flowing into it. It is interesting to note that the whitefish commonly regarded as exclusively freshwater fish are found in abundance in James bay. They run up the rivers to spawn. The James bay whitefish are not as large as those of the lakes but are of good flavour.

SEAL AND WHALE FISHERIES.

Hair seal-skins to the number of 4,872 were marketed by Quebec fishermen, 168 by Nova Scotians, and 2,520 by British Columbians. No fur seals are caught in the Atlantic or gulf of St. Lawrence, but 404 were caught along the coast of British Columbia. The catch of whales along the British Columbia coast was 705, while 87 whales were caught in the gulf of St. Lawrence by Quebec fishermen. British Columbia marketed 10,700 pounds of whalebone and 975,000 pounds of whalebone meal. Quebec marketed 24,000 pounds of whalebone.

FISH OIL AND WHALE OIL.

Nova Scotia marketed 56,895 gallons of fish oil in 1914, New Brunswick 50,242 gallons, Prince Edward Island 10,618 gallons, Quebec 90,400 gallons. British Columbia marketed 305,006 gallons of whale oil and Quebec 147,500 gallons.

FISH EXPORTING CENTRES.

The fish exporting business of the Atlantic and gulf coasts is to a great extent centred in Halifax and St. John, and especially Halifax, whose fish merchants get supplies from all parts of the Maritime Provinces and lower Quebec, but a considerable export business is done direct by fishing firms in the small fishing centres along the coasts of Nova Scotia, New Brunswick, Prince Edward Island and Quebec. Export shipments are often made from Lunenburg, Lockport, Shelburne, Yarmouth, Arichat, Port Hawkesbury, Port Hood, Canso, Digby and Yarmouth, in

Nova Scotia; Charlottetown, Summerside, Tignish, Souris and Murray Harbour, in Prince Edward Island; Chatham, Caraquet, Dalhousie and Grand Manan, in New Brunswick; Paspebiac and Gaspé in Quebec. Fish merchants of Montreal and Quebec city also get supplies from lower Quebec and the Maritime Provinces, and while their sales are chiefly in the home market the excellent shipping facilities during the season of St. Lawrence navigation enable them to do a considerable export business. On the Pacific coast the export of fish largely centres in Vancouver city and New Westminster, but export shipments are also made from Victoria, Nanaimo and Prince Rupert.

CLASSIFICATION OF FISH FOR EXPORT.

The Canadian Cusutoms Department does not adopt the same classification of fish as the Marine and Fisheries Department in the statements of exports. For instance, while the statistics of the Fisheries Department show the quantities of salmon marketed, fresh, canned, salted, mild cured and smoked, they give no pickled salmon, whereas the Customs Department reports the export of 48,058 barrels of pickled salmon during the fiscal year 1914, while no exports of salted or mild cured salmon are shown. The explanation is that the Customs Department classifies salted and mild cured salmon as pickled. The Customs Department also reports the export of 4,610,345 pounds of dog salmon, whereas the Fisheries Department does not make a separate classification of dog salmon, but includes it with dry-salted or dried salmon. Codfish, haddock, pollack and hake or codlings are classified together in the Customs report of exports, being divided into fresh, dry-salted, wet-salted and pickled, whereas the Fisheries Department classifies codfish, haddock, hake and pollack separately and divides them into fresh dried, green-salted and smoked. The Customs Department reports the export of 29,444 barrels of pickled mackerel, but the statistics of the Fisheries Department show no production of pickled mackerel, but give the quantities marketed fresh, salted and canned. The Fisheries report shows the production of fresh, dry-salted, pickled, canned and smoked herring, while the Customs report shows the export of fresh or frozen, pickled, canned and smoked herring. There are similar differences of classification as regards other kinds of fish. Owing to such differences in classification it is impossible to decide what proportions of the different preparations of fish marketed by fishermen are exported. In comparing exports with production it must also be noted that fish marketed by the fishermen in one fiscal year may be exported in the following fiscal year. Thus if fish marketed by fishermen in March were exported in April they would appear in the exports of the following fiscal year.

EXPORTS OF SALMON.

The total exports of fresh salmon amounted to 4,432,562 pounds, valued at $364,564, in 1914; canned salmon exports, 61,097,424 pounds, valued at $6,631,437; smoked salmon exports, 45,100 pounds, valued at $7,116; pickled salmon exports, 48,058 barrels, valued at $372,019; and dog salmon, $403,658 pounds, valued at $42,193.

Following are the countries to which salmon was exported, with the quantities of each kind:—

—	Canned.	Pickled	Smoked.	Fresh.	Dog Salmon.
	Lb.	Brl.	Lb.	Lb.	Lb.
United Kingdom	48,862,562	66	38,496	1,095,924	
Australia	2,670,396	...	...	18,131	
British Straits Settlement	2,191,628	...	...	...	
France	2,019,784	...	...	18,000	
New Zealand	1,354,362	...	...	504	
United States	1,181,205	4,149	5,954	3,148,401	
Fiji Islands	764,908	...	...	...	26,256
British India	533,136	...	...	...	
Dutch East Indies	377,932	...	...	...	
Belgium	311,332	...	...	...	
Hong Kong	202,143	350	...	1,275	
British South Africa	116,396	...	...	...	
German Oceania	88,800	...	...	...	
Chili	81,600	...	...	...	
China	80,304	5,681	...	...	115,200
Japan	4,356	28,381	...	...	3,023,500
Holland	70,900	...	...	...	
Siam	57,600	...	...	...	
Philippines	24,096	...	...	...	
British Oceania (Colonies not specified)	23,088	...	...	...	
French Oceania	22,896	...	...	...	
British West Indies	21,248	1,081	650	1,050	
Bermuda	11,176	22	...	267	
Norway	13,200	...	...	...	
Sweden	3,000	180	...	...	
Germany	6,012	6,410	...	148,810	
Newfoundland	2,208	13	...	200	
Miquelon and St. Pierre	708	...	...	...	
Venezuela	10	...	...	...	
Colombia	...	26	...	...	
Denmark	...	1,274	...	...	
Danish West Indies	...	118	...	...	
Dutch Guiana	...	117	...	...	
Panama	...	259	...	...	
Costa Rica	...	27	...	...	
Alaska	...	4	...	...	

EXPORTS OF LOBSTERS.

The United States was the only country to which fresh lobsters were exported in 1914. The quantity was 4,943,930 pounds and the value $707,486. The total quantity of canned lobsters exported was 8,271,662 pounds, valued at $2,083,987. Following are the countries to which canned lobsters were exported, with the quantities:—

	Pounds.
United Kingdom	2,875,206
United States	2,273,849
France	1,946,674
Germany	472,808
Belgium	299,728
Sweden	175,053
Denmark	89,182
Holland	78,816
Norway	36,650

	Pounds.
Australia	14,576
Russia in Europe	5,160
British West Indies	1,976
New Zealand	1,864
Bermuda	48
Venezuela	48
Danish West Indies	24

EXPORTS OF OYSTERS AND CLAMS.

The total quantity of fresh oysters exported in 1914 was 342 barrels, valued at $2,513, of which 297 barrels went to the United States, 36 barrels to the United Kingdom and 9 barrels to other countries. The exports of oysters preserved in cans were 4,169 pounds, valued at $1,547, of which 4,073 pounds went to the United States and 96 pounds to Hong Kong. The total quantity of clams exported was 49,205 barrels, valued at $103,904, of which all but 19 barrels went to the United States.

EXPORTS OF CODFISH, HADDOCK, HAKE AND POLLACK.

The total exports of codfish, haddock, hake and pollack were 2,052,064 pounds fresh, valued at $66,149; 74,648,200 pounds dry-salted, valued at $4,564,731; 1,272,900 pounds wet-salted, valued at $53,185; 612,500 pounds pickled, valued at $23,165, and 198,535 pounds of tongues and sounds, valued at $34,872. All the fresh went to the United States. Following are the countries to which the various other preparations of codfish, haddock, hake and pollack were sent:—

—	Dry-salted.	Wet-salted.	Pickled.	Tongues and Sounds.
	Lb.	Lb.	Lb.	Lb.
United States	19,883,300	1,071,100	611,700	197,105
British West Indies	15,159,400			180
Brazil	9,652,700			
Porto Rico	7,609,300			
Cuba	7,588,700			
Italy	6,119,200			
United Kingdom	2,507,300			
Panama	1,899,300			
Portugal	706,500			
Newfoundland	925,400	201,800		
Dutch Guiana	571,300			
Bermuda	369,000			1,250
San Domingo	381,500			
Hayti	350,300			
Hawaii	259,200			
Austria-Hungary	172,400			
Colombia	160,100			
Danish West Indies	56,000			
Spain	46,800			
Dutch West Indies	17,900			
British Honduras	16,300			
Guatemala	16,000			
Nicaragua	1,000			
British South Africa	600			
Ecuador	400			
Miquelon and St. Pierre	100			

EXPORTS OF HERRING.

The exports of herring in 1914 were 10,662,576 pounds fresh, valued at $143,116; 342,147 barrels pickled, valued at $793,402; 32,640 pounds canned, valued at $1,834; and 3,606,225 pounds smoked, valued at $89,931. Following are the countries to which herring were exported, with the quantities:—

—	Herring.			
	Pickled.	Smoked.	Canned.	Fresh or Frozen.
	Brl.	Lb.	Lb.	Lb.
United States	57,960	2,339,120	32,450	10,283,574
Japan	124,179	....	....	
Hong Kong	83,825	240	....	
China	39,149	....	....	
British West Indies	31,949	1,040,411	....	3,300
Cuba	25	44,546	....	
Panama	90	39,130	....	
Dutch Guiana	3	35,300	....	
United Kingdom	1,499	29,460	....	
Bermuda	49	22,964	190	200
Newfoundland	69	22,314	....	375,000
San Domingo	....	11,500	....	
Danish West Indies	253	7,210	....	
New Zealand	....	4,900	....	
Costa Rica	17	4,220	....	
French West Indies	....	2,400	....	502
Miquelon and St. Pierre	3	1,350	....	
Colombia	10	650	....	
Porto Rico	3,061	500	....	
France	....	10	....	
Germany	6	....	....	

FISH OIL EXPORTED.

The quantity of cod oil exported was 373,517 gallons, valued at $112,790, while 662,451 gallons of whale oil, valued at $293,894, and 858 gallons of seal oil, valued at $209, were exported. Exports of other fish oils amounted to 129,778 gallons, valued at $40,799. Following are the countries to which fish oil was exported, with the quantities:—

—	Cod Oil.	Seal Oil.	Whale Oil.	Other Fish Oil.
	Gal.	Gal.	Gal.	Gal.
United Kingdom	28,734	....	427,571	100,683
United States	335,177	858	234,880	29,095
Newfoundland	8,086	....	....	
British West Indies	1,438	....	....	
Cuba	82	....	....	

The value of marine furs or skins exported was $45,203, of which $42,209 represented exports to the United Kingdom, and $3,174 exports to the United States.

EXPORTS OF MACKEREL AND HALIBUT.

The exports of mackerel were 4,027,141 pounds fresh, valued at $216,516, and 29,444 barrels pickled, valued at $343,692. Fresh halibut exports amounted to $4,619,345 pounds, valued at $282,304, while only five barrels of pickled halibut were exported. Following are the countries to which mackerel and halibut were exported, with the quantities:—

—	Mackerel.		Halibut.	
	Pickled.	Fresh.	Pickled.	Fresh.
	Brl.	Lb.	Brl.	Lb.
United States	22,128	4,023,944	1	4,278,312
United Kingdom	......	......	4	326,410
British West Indies	5,173	......	......	44
Bermuda	72	63	......	
Newfoundland	......	3,134	......	5,359
Costa Rica	67	......	......	
Cuba	44	......	......	
Danish West Indies	17	......	......	
Dutch Guiana	22	......	......	
Hayti	5	......	......	
Miquelon and St. Pierre	1	......	......	100
Panama	1,151	......	......	
Porto Rico	28	......	......	
Colombia	116	......	......	
Japan	......	......	......	120

FRESHWATER FISH EXPORTED.

Freshwater fish to the value of $1,524,443 were exported in 1914, but the Trade and Navigation Report of the Customs Department does not specify the different kinds of freshwater fish exported, with the exception of salmon trout, of which 712,045 pounds, valued at $39,035, were exported.

EXPORTS OF SMELTS AND OTHER SEA FISH.

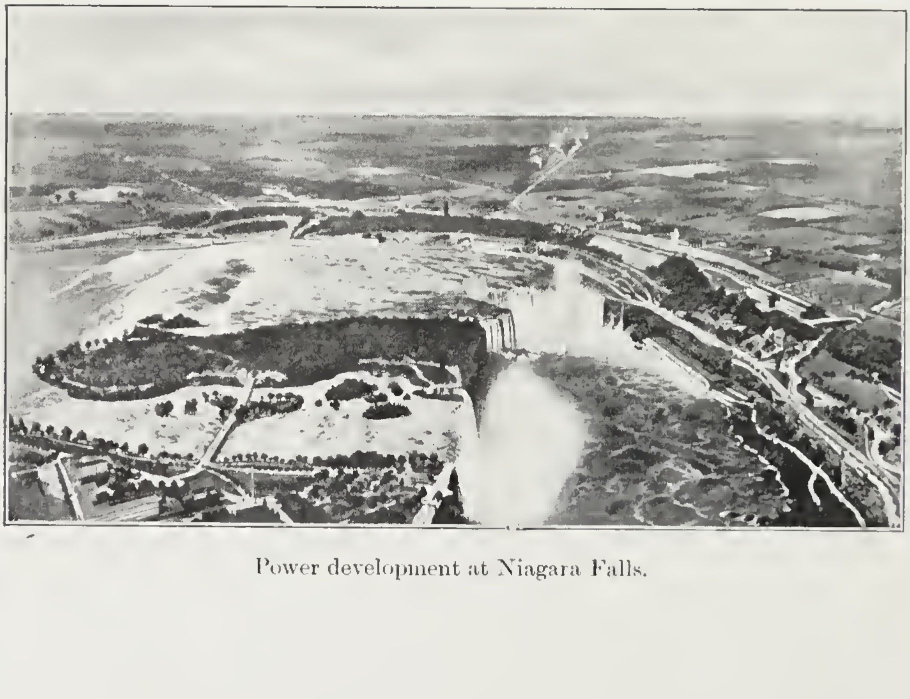
The exports of smelts in 1914 amounted to 6,028,034 pounds, valued at $332,792, all going to the United States. The exports of other sea fish of kinds not specified were: Fresh, 1,960,857 pounds, valued at $96,109; pickled, 21,598 pounds, valued at $113,642, and preserved, 3,088,747 pounds,

valued at $145,144. Following are the countries to which smelts and other kinds of sea fish not specified were exported, with the quantities:—

—	Smelts.	Other Sea Fish.		
		Fresh.	Pickled.	Preserved.
	Lb.	Lb.	Brl.	Lb.
United States	6,028,034	1,953,457	10,173	2,356,346
United Kingdom	....	....	....	229,657
British West Indies	....	7,400	10,684	344,349
Newfoundland	....	....	....	15,170
Japan	....	....	....	
Miquelon and St. Pierre	....	....	....	
Hayti	....	....	335	30,000
Danish West Indies	....	....	77	
Dutch Guiana	....	....	138	
Panama	....	....	76	
Costa Rica	....	....	48	
Denmark	....	....	51	
Porto Rico	....	....	11	
Colombia	....	....	5	
Australia	....	....	....	6,000
Bermuda	....	....	....	5,151
British South Africa	....	....	....	12,000
Hong Kong	....	....	....	1,080
New Zealand	....	....	....	12,243
Alaska	....	....	....	151
Germany	....	....	....	2,100
Turkey	....	....	....	4,500

A whaling vessel with whale in tow.

Niagara Falls.



Power development at Niagara Falls.

Chapter XIV.

THE WATER-POWERS OF CANADA.

A complete enumeration of the water-powers of Canada has never been made. In 1911 the Canadian Conservation Commission published a volume of 397 pages on the water-powers of Canada in which 969 water-powers were enumerated and an estimate given of the horse-power that can be developed. The description of the water-powers of the eastern provinces in this report is very comprehensive although not all-embracing, but the account of the water-powers of the western provinces is not so complete. The Dominion Water Power Branch of the Department of the Interior issued in 1914 thirteen volumes on the water-powers of the western provinces under the title "Water Resources Papers." These volumes are numbered from 1 to 13 and further numbers are to be issued. The Conservation Commission is publishing a report on the water-powers of Manitoba, Saskatchewan and Alberta prepared jointly by Mr. Leo G. Denis, hydro-electric engineer of that commission and Mr. J. B. Challies, Superintendent of the Dominion Water Power Branch, while Mr. Arthur V. White is preparing for the Conservation Commission a report on the water-powers of British Columbia. Mr. G. R. G. Conway has prepared for the Water Power Branch a monograph on the water-powers of British Columbia which is being published.

The annual reports of the Hydro-Electric Power Commission of the province of Ontario contain a great deal of valuable information about the water-powers of that province. A great deal of information is also obtainable from the reports of the International Waterways Commission, a joint commission representing the interests of Canada and the United States in the waterways and water-powers along the frontier.

It should be noted that the reports of the Conservation Commission and the Dominion Water Power Branch do not claim to cover all the water-powers of Canada, but only those that have been investigated.

In many cases the estimates are very exact, but in some cases they are only approximate. Care has been taken in estimating to take into consideration only the minimum flow of water. In many cases the minimum flow of water is for a very brief period of the year and for nearly the whole year much greater power is available, so that a statement of the minimum power underestimates the real power possibilities, but it is considered best in this article to accept minimum calculations rather than risk exaggeration. In some cases the storage conditions may be greatly improved and the discharge controlled during the period of high water. For instance the power possibilities of the slope between the height of land and James bay in the province of Ontario are estimated at 400,000 horse-power, but it is calculated that under discharge control over 2,000,000 horse-power could be developed on the James Bay slope. In the statement of the power possibilities of the Winnipeg River system the minimum power available under

natural conditions of water flow is estimated to be 280,300 horse-power in Manitoba and 203,838 horse-power in Ontario, a total of 484,138 horse-power at the lowest stage of the water-flow, but it is calculated that if the discharge of water were controlled by dams at lake of the Woods, Rainy lake, lake Seul and other lakes along this river system this could be increased to nearly a million horse-power. The power estimates for the Ottawa river are based on present conditions. If the Ottawa and Georgian Bay Canal project is carried out the power conditions will be completely changed and many new water-powers will be created.

Owing to the wonderful system of lake reservoirs the variations of water-flow on the Niagara river and the St. Lawrence river are remarkably small. They are believed to be less than on any other river system in the world. Referring to this natural regulation of water-flow the International Waterways Commissioners in their report for the year 1910 said: "No work of man ever approached or ever will approach this perfection of regulation."

As might be expected more exact information is obtainable regarding the large water-powers than about the small water-powers. In the older settled parts of the eastern provinces most of the small water-powers were utilized from the earliest days of settlement to run saw mills, grist mills and woollen factories. The methods adopted for the utilization of the water-powers were primitive and in many cases little or no alteration has been made. The estimates regarding most of these small water-powers are based on the development under such conditions. It is probable that in the future modern engineering skill will be employed in reconstruction work at some of these small water-powers and that the power developed will be considerably increased. On the other hand at some of these small water-powers the full power already developed is not available at lowest water, and in some cases no power at all at certain seasons of the year. But these small water-powers form a very small proportion of the total.

DEVELOPED WATER-POWERS.

In the volume on the Water-powers of Canada issued by the Conservation Commission in 1911 the water-power known to be developed in Canada in 1910 was stated to be 1,016,521 horse-power for 24 hours daily. In a statement issued by the Dominion Water Power Branch in 1915 the developed power was stated to be 1,712,193, 24-hour horse-power, while it was estimated that within areas that may reasonably be expected to be populated in the near future, there were water-power possibilities aggregating 17,764,000, 24-hour horse-power.

The developed water-powers were stated to be distributed as follows:—

Province.	Horse-power Developed.
Nova Scotia	21,412
New Brunswick	13,390
Prince Edward Island	500
Quebec	520,000
Ontario	789,466
Manitoba	56,730
Saskatchewan	45
Alberta	33,305
British Columbia	265,345
Yukon	12,000
	1,712,193

Assuming that the developed power is 1,700,000 twenty-four-hour horse-power, if it were all used constantly it would be equivalent to 40,800,000 horse-power hours daily; but even if there were a constant demand for all the power that could be produced during the twenty-four hours, there would occasionally be loss from stoppages. However, there is not a constant demand. Except during the hours from 7 a.m. to 6 p.m. there is little demand for power purposes, while the demand for lighting is limited to the hours of darkness, which vary at different seasons of the year. It has been estimated that under present conditions the consumption does not greatly exceed one-fourth of the power that could be developed during twenty-four hours by the hydro-electric plants now in operation. On this basis the consumption would be equal to about 10,200,000 horse-power hours daily if the power developed is 1,700,000 horse-power. It will be interesting to consider what amount of coal would be required to produce this amount of power with steam plants. The amount of bituminous coal required to produce one horse-power for one hour depends upon the character of the plant and the efficiency of operation. Competent authorities have expressed the opinion that six pounds would be a fair average, although at large well-equipped and economically operated plants the average would not exceed four pounds, and in some cases the quantity is a great deal less than four pounds, while in other cases it is eight pounds and even higher. Assuming the low average of four pounds of coal per horse-power hour and estimating that the present daily consumption in Canada is equal to 10,200,000 horse-power hours, this would represent a saving of 20,400 tons of coal daily, or 7,446,000 tons per year. But in the districts where hydro-electric power has been developed the demand is constantly increasing and a larger proportion of the power developed will soon be used.

It is impossible to make an accurate estimate of the total water-powers of Canada, but in the eastern provinces and the Prairie Provinces as far north as the Saskatchewan and Nelson rivers, a close approximation may be made from the information available.

THE NIAGARA WATER-POWER.

In any review of the water-powers of Canada the Niagara power demands first attention. The amount of water that can be diverted for power on the Canadian and American sides of the Niagara river above the falls has been settled by an international agreement which takes into consideration the fact that more water passes over the Canadian falls than over the American falls, and also makes allowance for the diversion of 10,000 cubic feet of water from the international lakes by the Chicago drainage canal. This agreement is intended to preserve the scenic beauty of the Niagara waterfall and protect navigation interests, allowing reasonable use of the water for power purposes. It provides that 36,000 cubic feet of water per second above the fall may be diverted for power purposes on the Canadian side and 20,000 cubic feet on the American side. Investigations made by the United States Government at existing power plants at Niagara Falls show that it takes about ·075 of a cubic foot of water

per second to actually develop one horse-power per hour. On this basis 36,000 cubic feet of water per second would yield 480,000 horse-power. A yield of 450,000 horse-power may be accepted as a minimum.

The International Waterways Commission has reported that 40,000 cubic feet of water per second can be diverted for power purposes at the rapids below the falls without injury to the scenic beauty of the rapids, and if this were divided equally between Canada and the United States it has been estimated that 215,000 horse-power could be produced on the Canadian side, but it might be somewhat less. The conditions regarding head of water below the falls being different from those above the falls, an estimate cannot be made on the same basis. However a minimum of 150,000 horse-power below the falls is probably an inside estimate. We may therefore assume that 600,000 horse-power can be produced above and below the falls on the Canadian side. However, as the Canadian Government permits the exportation to the United States of a portion of the power generated on the Canadian side, the amount of power available for Canadian home consumption is somewhat less. On the other hand part of the power produced on the United States side of the upper St. Lawrence river may be exported to Canada. Recently a proposal has been made in the United States that a great dam should be constructed across the Niagara river below the falls, creating a new waterfall. It is stated that in this way two million horse-power could be generated and that capital will be available for the enterprise if the Governments of Canada and the United States consent.

ONTARIO AND QUEBEC WATER-POWERS.

The available water-powers of Ontario and Quebec for which estimates have been made are distributed as follows:—

	Approximate minimum 24-hour h.-p. available.
Niagara falls and rapids	600,000
DeCew falls	50,000
Welland river and canal developed	8,833
St. Lawrence canals in Ontario developed	8,260
Rapids of St Lawrence river in Ontario	1,028,000
Ontario tributaries of the St. Lawrence	1,565
Tributaries of lake Ontario, including Trent Valley powers	102,062
Tributaries of lake Erie and lake St. Clair	7,873
Tributaries of lake Huron	8,112
Tribtuaries of Georgian bay on the south and west	43,828
Tributaries of north side Georgian bay and lake Huron	92,006
Sault Ste. Marie	98,200
Nepigon river and tributaries	79,340
Kaministiquia river	31,265
Other tributaries of lake Superior	62,532
Winnipeg and English River system in Ontario	203,838
James Bay slope under natural flow	800,000
Ontario tributaries of the Ottawa river	87,920
Ottawa river from its mouth to lake Timiskaming	422,162
Quebec tributaries of the Ottawa	433,490
St. Lawrence river in Quebec, above Montreal, including Lachine, Coteau, Cedar and Cascades rapids and Beauharnois canal	1,388,135
South of St Lawrence below Lachine rapids and above Chaudiere river	61,430

	Approximate minimum 24-hour h.-p. available.
South of St. Lawrence from Chaudière river to Rivière du Loup..	10,260
South of St. Lawrence below Rivière du Loup..	53,260
North side St. Lawrence between Ottawa river and St. Maurice river..	21,842
St. Maurice River basin..	358,450
North shore of St. Lawrence between St. Maurice and Saguenay rivers..	30,736
Saguenay River basin, allowing about 60 per cent of approximate estimate of 1,003,760 h.-p..	602,000
North side of St. Lawrence, below Saguenay, including Hamilton river, allowing about 60 per cent of approximate estimate of 1,229,540 h.-p..	737,000
James Bay slope in Quebec..	971,500
	8,403,899

NOTE.—As doubt is expressed in the Conservation Commission Report regarding estimates for some of the water-powers of the Saguenay River basin and rivers below the Saguenay, especially the Hamilton river only 60 per cent of the estimates is allowed in the above tables.

Thus Ontario and Quebec have available approximately 8,400,000 24-hour horse-power and by controlling the discharge of waters on rivers where the difference between high and low water is great this could be enormously increased. Some allowance should be made for Niagara power exported to the United States, but it may be safely said that Ontario and Quebec have available for home consumption when developed a minimum of 8,200,000 24-hour horse-power. If 80 per cent of this power were developed and one-fourth of the developed power consumed it would be equivalent to an annual saving of 28,732,000 tons of coal at the low average of four pounds of coal per horse-power which would be more than the total consumption of coal in all the provinces of Canada in 1913. The total production of coal in Canada in 1913 was 15,115,089 tons of which 2,055,993 tons were exported, while the imports were 11,060,910 tons of bituminous and 4,237,310 tons of anthracite, so that the consumption of coal for the whole of Canada was 28,357,000 tons.

WATER-POWERS OF THE MARITIME PROVINCES.

All parts of the Maritime Provinces are so near to the great coal fields of Nova Scotia that water-power is not a matter of such great importance to them as it is to some of the other provinces.

New Brunswick and Nova Scotia have been estimated to have 385,307 24-hour horse-power available for 8 months of the year. There is no estimate of the amount of power available for the remaining four months in those provinces. In some cases there would be very little power available for those months.

In Nova Scotia there are no large rivers or large lakes, but there are many small rivers with numerous small waterfalls and there are a number of small lakes which serve as reservoirs. The natural storage facilities could be improved easily in many cases. The rainfall of this province is

heavy. Thus while there are no great water-powers there are many small ones. The rivers of New Brunswick are larger and there are greater water-powers than in Nova Scotia but there are not so many of them.

In view of the fact that some of the small water-powers can be utilized for only eight months of the year it should be noted that at such water-powers it is customary to have a supplementary steam plant which can be utilized for the production of power when water-power is not available.

The water-powers of Prince Edward Island are hardly worthy of mention although there are a few small water-powers on the little rivers at which during certain seasons of the year from five to fifty horse-power is developed.

The water-powers of New Brunswick and Nova Scotia for which approximate estimates have been made are distributed as follows:—

	Approximate minimum 24-hour h.-p. for 8 months.
Three water-powers on St. John river, in New Brunswick.. ..	162,000
Thirteen water-powers on St. Croix river, in New Brunswick	35,380
Six water-powers on Nipisquit river, in New Brunswick.. ..	13,795
One water-power on the Aroostook river in New Brunswick..	13,000
Three water-powers on Tobique river, in New Brunswick	7,600
Two water-powers on southwest branch Miramichi river, in New Brunswick..	7,000
One hundred and thirteen water-powers on other New Brunswick rivers..	54,363
Twelve water-powers on Liverpool river, in Nova Scotia.. ..	14,995
Eleven water-powers on the Lahave river, in Nova Scotia.. ..	8,430
Nine water-powers on Weymouth river, in Nova Scotia..	6,160
Ten water-powers on Port Medway river, in Nova Scotia.. ..	6,120
One hundred and sixty-nine small water-powers on other Nova Scotia rivers..	56,884

There are a number of small water-powers for which no estimate has been made. The Dominion Water Power Branch and a commission appointed by the Nova Scotia Government are making a joint investigation of the water resources of Nova Scotia and the best means of promoting their development so that more complete information will soon be available.

WATER-POWERS OF PRAIRIE PROVINCES.

In Manitoba the water-powers that have been most carefully estimated are those on the Winnipeg river about 78 miles from the city of Winnipeg. Under natural flow the minimum power available is 280,300 horse-power of which 45,700 horse-power has already been developed by the city of Winnipeg and 26,500 horse-power by the Winnipeg Electric railway. It is estimated that with control of the discharge of water the power available would be over 509,900 horse-power.

On the Pigeon river, Berens river, Poplar river and Big Black river flowing into the southeast side of lake Winnipeg probably within transmission distance of the city of Winnipeg there are water-powers aggregating 72,225 horse-power 24 hours daily eight months of the year. No estimate has been made for the remaining four months.

Other water-powers within transmission distance of the city of Winnipeg are those on the Mossy, Dauphin, Waterhen and Fairford rivers, which make connections between lake Dauphin, lake Manitoba, lake Winnipegosis and lake Winnipeg. Theoretically these rivers would furnish a

minimum of 27,860 horse-power 24 hours daily throughout the year, and it may be assumed that a minimum of at least 65 per cent of that could be developed. With control of the discharge of waters this could be considerably increased. The water-power at the Grand falls of the Saskatchewan may also be regarded as within transmission distance of the city of Winnipeg. The estimate from May to November is a minimum of 45,000 horse-power for 24 hours daily and while no estimate for the whole year has been made the power available throughout the year would probably not be much less.

There are small water-powers available on the Assiniboine, Little Saskatchewan and other small rivers for at least seven months of the year.

The water-powers of the Nelson and Hayes rivers are too far from the present settlements for transmission of electric energy, but the construction of the Hudson Bay railway from the Pas to Port Nelson will probably bring about the settlement of the Nelson River valley. Estimates have been made regarding twenty-five water-powers on the Nelson river aggregating a minimum of 2,930,800 horse-power for 24 hours daily and 20 water-powers on the Hayes river aggregating 28,460 horse-power. While the estimates are only for seven months it is believed that the minimum for the year would be very little less than this for the Nelson river.

As Manitoba is even farther from the sources of coal supply than Ontario the abundance of water-power is of very great importance.

On the main Saskatchewan river in the province of Saskatchewan it is estimated that about 24,000 horse-power daily for 24 hours would be available for seven months of the year, on the South Saskatchewan 1,700 horse-power and on the North Saskatchewan 10,000 horse-power. At the Rocky rapid of the North Saskatchewan in Alberta above Edmonton it is estimated that 28,000 horse-power could be developed by controlling the discharge of waters.

In southern Alberta it is estimated that 60,000 horse-power can be obtained from the Bow river within 50 miles of Calgary, by controlling the discharge of waters. The Calgary Power Company has already developed 19,500 horse-power at the Horseshoe fall of the Bow river and 12,000 horse-power at the Kanaskis fall. There are also small water-powers available on the Elbow river, McLeod river, Belly river and other small rivers in southern Alberta.

WATER-POWERS OF THE NORTHERN ZONE.

The information regarding water-powers in Manitoba, Saskatchewan and Alberta north of the Nelson and Saskatchewan River systems is not at all complete, but estimates have been made for seven months of the year from May to November on the following rivers:—

	Minimum 24-hour h.-p. 7 months
Churchill river, above Indian lake	472,700
Reindeer	33,900
Geikie	42,100
Athabasca	392,900
Lesser Slave	12,400
Slave	936,000
Peace in Alberta	140,000
Peace canyon in British Columbia	416,000
	2,406,000

Even if the water-power during the remaining five months of the year were not more than one-third of this there would be a large amount of power available throughout the year.

BRITISH COLUMBIA WATER-POWERS.

British Columbia is splendidly endowed with water-powers and although the province has immense quantities of coal rapid progress is being made in hydro-electric development. At many points to which the cost of transporting coal over mountain roads is excessive hydro-electric power can be cheaply transmitted and even in districts close to coal mines the competition of hydro-electric power will regulate the price of coal.

Mr. G. R. G. Conway, Consulting Engineer of the British Columbia Electric Railway, says in his monograph on the water-powers of British Columbia: "Within reasonable distance of the cities of Vancouver and Victoria there are possibilities of the economic development of water-powers aggregating 750,000 horse-power. These water-powers are all situated within an area of 20,000 square miles. Outside of this area a rough estimate of the water-power possibilities of the province would bring this figure up to 3,000,000 horse-power." The horse-power capacity of plants already installed at developed water-powers is stated to be as follows:—

	Horse-power developed.
Kootenay river and Kettle river	23,000
Coldstream, near Victoria	3,000
Lake Buntzoen, Burrard inlet	84,500
Stave lake, near Ruskin	26,000
Jordan river, 40 miles from Victoria	25,000
Link river, Ocean falls	11,200
Puntledge river, near Nanaimo	9,500
Powell river	24,000
Falls creek, near Granby bay	7,325
Kootenay river, near Nelson	4,000
Barriere river, near Kamloops	2,800
Similkameen river, near Hedley	2,650
Britannia creek, Howe sound	2,540
Woodworth lake, near Prince Rupert	1,650
Swanson bay, 130 miles south Prince Rupert	1,250
Illecillewaet river at Revelstoke	600
Other small developments	890

It should be noted that these figures do not represent power possibilities of these water-powers but developed horse-power. For instance at Woodworth lake near Prince Rupert only 1,650 horse-power has been developed, but it is estimated that 10,000 horse-power can be developed at that point.

THE ONTARIO HYDRO-ELECTRIC POWER COMMISSION.

The Ontario Hydro-Electric Power Commission is a Government corporation, appointed by the Provincial Legislature of Ontario in May, 1906, to provide for the development, generation, transmission and distribution of electrical energy at cost to the various municipalities desiring it. It has authority to regulate the electric wiring installations, arrange for the distribution of electrical energy to the farmers in the rural districts, and provide for the construction, operation and maintenance of a system of

electric railways. The Ontario Government provides the capital but the municipalities purchase power at rates covering the cost of power, the operating expenses and the interest and sinking fund charges. The municipalities provide their own plants for local distribution.

The members of the Hydro-Electric Power Commission are: Sir Adam Beck, K.B.; Hon. I. B. Lucas, and Mr. W. K. McNaught, C.M.G.

The commission has constructed and is operating five separate transmission systems, known as the Niagara, Severn, Port Arthur, St. Lawrence, and Wasdell's Falls systems, and have under construction a sixth system to be known as the Eugenia Falls system, while they are also supplying power to the city of Ottawa.

The Niagara system is supplied with power purchased from the Ontario Power Company, Niagara Falls, the Severn system with power generated at a plant owned and operated by the commission at Big Chute, on the Severn river; the Port Arthur system with power from Kakabeka falls, purchased from the Kaministiquia Power Company; the Wasdell's Falls system with power generated at a plant constructed, owned and operated by the commission at Wasdell's falls, on the Severn river; the St. Lawrence system with power purchased from the York and Ontario Power Company, Morrisburg, Ontario; the Ottawa system with power purchased from the Ottawa and Hull Power Company, Hull, Quebec, and the Eugenia Falls system with power generated at Eugenia falls, on the Beaver river.

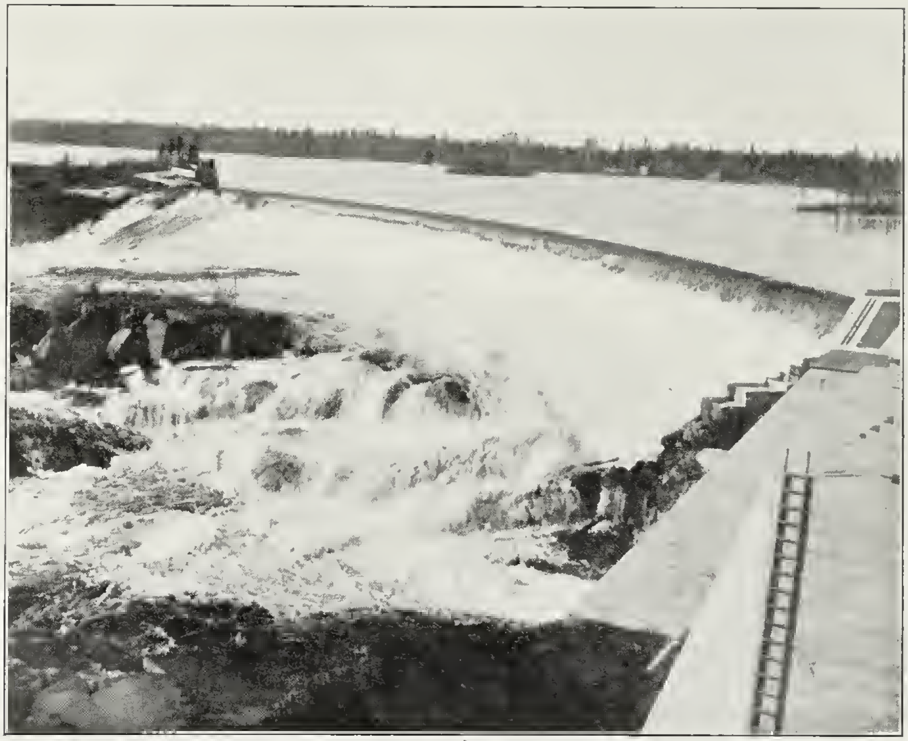
The commission has constructed 15 transforming and 47 distributing stations; 433 miles of 110,000 volt steel tower transmission lines and 815 miles of low tension steel lattice and wood pole lines, distributed as follows: Niagara system, steel tower lines, 433 miles, low tension lines, 598 miles; St. Lawrence system, low tension lines, 61 miles; Severn system, low tension lines, 80 miles; and Wasdell's Falls system, low tension lines, 59 miles. The commission is at present supplying 72 municipalities with power.

The maximum 20 minutes' load on the Niagara system at Niagara station for October, 1914, was 67,000 horse-power; the minimum load, 60,000 horse-power, and the average load, 63,500 horse-power. The average load factor on this system is about 85 per cent in summer and 80 per cent in winter.

THE COST OF POWER IN ONTARIO.

The price paid by the municipality depends partly upon the distance from the source of power and partly upon the quantity taken by the municipality, and ranges from $14 to $54 per horse-power per year. The cost to the consumer depends to some extent upon the economy of management in local distribution. If the local consumption is less than the quantity the municipality agrees to purchase from the Hydro-Electric Power Commission this may necessitate a higher charge to the users of power.

Toronto, Hamilton and Ottawa may be taken as examples of the cost of power in the large industrial centres, while the rates at thirteen of the smaller manufacturing cities are also shown in the following table:—



Spillway Lac Du Bonnet Power Plant, Winnipeg River.

The Chaudiere Falls at Ottawa.

City.	Cost of power to municipality per horse-power per year.	Cost to the Consumer.				
		Fixed rate per horse-power per month.	1st 50 hours per month per kw. hr.	2nd 50 hours per month per kw. hr.	Additional horse power per kw. hr.	Prompt payment discount.
			Cents.	Cents.	Cents.	Cents.
Toronto............	15·00	$1.35 per horse-power for first 10 horse-power and $1 for each additional horse-power........	1·5	1	0·5	10
Hamilton	15·00	$1 per horse-power...	2·1	1·4	0·2	27·5
Ottawa	15·00	1 〃 〃 ...	1·8	1·2	0·15	25
St. Catharines..	14·00	1 〃 〃	1·8	1·2	0·15	25
Welland	14·00	1 〃 〃	1·8	1·2	0·15	25
Peterborough.........	18·00	1 〃 〃	1·3	0·8	0·1	11
Brantford............	19·50	1 〃 〃	1·9	1·3	0·15	10
Guelph	21·00	1 〃 〃	2·0	1·5	0·2	25
Galt..................	21·50	1 〃 〃	2·0	1·5	0·2	25
Berlin..............	21·50	1 〃 〃 .. .	2·1	1·4	0·2	10
Port Arthur	22·50	1 〃 〃 ..	2·0	1·3	0·15	10
London......... ...	23·00	1 〃 〃	2·5	1·7	0·2	10
St. Thomas........ ..	28·00	1 〃 〃 . ..	2·5	1·7	0·2	10
Stratford	30·00	1 〃 〃	3·6	2·4	0·3	10
Collingwood	33·97	1 〃 〃	3·6	2·4	0·3	10
Windsor..	38·33	1 〃 〃 . ..	3·6	2·4	0·3	10

Note.—It has been announced that the above rates will soon be reduced.

In addition to the power distributed by the Ontario Hydro-Electric Power Commission, power is supplied to a number of cities, towns and villages by private companies having plants located at different parts of the province. A number of manufacturing companies control water-powers and generate their own electric power.

COST OF POWER IN WINNIPEG.

In the city of Winnipeg, in the province of Manitoba, power rates aro as follows:—

	Per kw. hr.
The first 50 hours' use per month of total connected load......	3½c.
The next 50 " " " " " "	2.5c.
The next 50 " " " " " "	1.9c.
The next 50 " " " " " "	1.4c.
The next 50 " " " " " "	1.1c.
Excess over 250 hours' use " " " "	0.8c.

These rates are subject to a monthly minimum payment of 75 cents per horse-power of total connected load, but in no case less than $1 net per month per meter. Prompt payment discounts are allowed for one year contract 10 per cent; 3 year contract 15 per cent; 5 year contract 20 per cent. Wholesale discounts are allowed on gross bills of over one hundred dollars per month as follows: Excess over $100 ten per cent; excess over $200 twenty per cent; excess over $300 thirty per cent; excess over $400 forty per cent; excess over $500 fifty per cent; excess over $1,000 sixty per cent.

COST OF POWER IN MONTREAL.

The city of Montreal, which is the chief user of power for industrial purposes, gets its power through private corporations from Lachine rapids, eight miles distant, the Soulanges canal, 30 miles distant, Beauharnois canal, 29 miles distant, Cedar rapids, 30 miles distant, Chambly, 17 miles distant and Shawinigan Falls on the St. Maurice river, 86 miles distant There are many other sources of water-power in Quebec province near enough to Montreal for transmission of electric energy. The rates for electric power in Montreal are as follows:—

Horse-power.	
0–2	$60 00
2–6	50 00
6–10	45 00
10–25	40 00
25–50	30 00
50–60	35 00
60–70	34 00
70–80	33 00
80–90	32 00
90–100	31 00
100–150	30 00
Over 150	27 50

Rates based on the capacity of the motor up to 25 horse-power are as follows:—

Horse-power.	
0–1	$50 00
1–2	40 00
2–6	35 00
6–10	32 50
10–25	30 00

These rates are for general industrial load running 10 hours per day. The rates for intermittent users are as follows:—

Horse-power.	
0–1	$21 connected plus 3 cents kw.h.
1–2	18 connected plus 3 cents kw.h.
2–6	15 connected plus 3 cents kw.h.
6–10	15 connected plus 2½ cents kw.h.
10–25	12 connected plus 2½ cents kw.h.
25–50	12 tested plus 2 cents kw.h.
50–100	12 tested plus 1¾ cents kw.h.
100–150	12 tested plus 1¼ cents kw.h.
Over 150	12 tested plus 1 cent kw.h.

The larger units than 150 horse-power are treated on a separate basis, the rates being figured out in accordance with the special conditions.

The connected motor rating on one system in Montreal is about 120,000 horse-power in industrial motor applications.

Chapter XV.

CANADIAN MANUFACTURES.

According to the Dominion census of 1911 there were in Canada in 1910 over 19,000 industrial establishments employing not less than five hands. The total number of employees was 515,203, the amount of capital invested $1,247,583,609, and the output was valued at $1,165,975,639. Compared with the census figures for the year 1900 there was an increase of over 31 per cent in the number of industrial establishments, an increase of over 179 per cent in the amount of capital invested and an increase of over 142 per cent in the value of products. There is reason to believe that the census of 1921 will show as great a percentage of growth for the present decade as for the last. There will be in Canada as in other industrial countries occasional years of depression when little progress will be made, but the development of manufacturing industries will keep pace with the general growth of the country. Any present description of Canadian industries must be based to a considerable extent upon information gathered in the census of 1911 representing industrial conditions in 1910, but in some lines of industry more recent statistics are available. As regards exports of manufactures we have the annual reports of the Customs Department which show remarkable growth although the exports form a small proportion of the total production.

It is not within the scope of this review to enumerate all the manufacturing industries of Canada, but those industries in which large amounts of capital had been invested at the time of the last census and those which have exported sufficient quantities of their products during the last two years to receive separate classification in the customs reports will be mentioned, for the purpose of illustrating the large investments of capital that have already been made in the development of Canadian industries supplying the home market and the success that has been achieved by those who have sought orders for Canadian goods in outside markets. In the years that have elapsed since the census a number of large industries have been established and some of the lesser industries have grown in importance. Almost everything from a needle to a locomotive is now made in Canada. Any one requiring more complete lists of articles made in Canada with the names and addresses of the manufacturers should consult the Export Directory of Canada published by the Department of Trade and Commerce which contains a list of Canadian manufacturers, producers and exporters.

The census returns include among manufactures a variety of prepared food products that are not classified as manufactures in the customs reports. However the customs returns of exports of manufactures include biscuits, sugar, molasses and syrup produced in Canadian sugar refineries. In the census returns logs, square timber, lumber and pulpwood are classified as manufactured products. In the customs reports they are classified as forest products.

EXPORTS OF CANADIAN MANUFACTURES.

The growth of exports of Canadian manufactures since the beginning of the twentieth century as recorded in the customs reports, is shown in the following table:—

1901	$16,012,208
1902	18,462,970
1903	20,624,967
1904	19,864,049
1905	21,191,333
1906	24,561,112
1907	26,279,049
1908	28,507,124
1909	28,957,050
1910	31,494,916
1911	35,283,118
1912	35,836,284
1913	43,692,708
1914	57,443,452
1915	85,539,501

If prepared foods and forest products were included among the exports of manufactures as they are in tbe census classification, the figures in the table of exports would be much greater.

It is expected that the exports of Canadian manufactures for the fiscal year 1916 will show a greater growth than in any previous year of Canada's commercial development.

The rapid growth in the exports of manufactures during the last fifteen years marks a new stage of Canadian development. There was the period when it was supposed that Canada could never be anything but an agricultural and lumbering country. Then came the period in which general manufactures were gradually established to supply a portion of the home demand. In the first place the products of Canadian industries were often inferior to imported articles, but gradually they were improved. Industries that were started on a small scale expanded with the growth of the country, and goods were produced which compared favourably with those manufactured in any other country.. Then began the export of Canadian manufactures, and the steady growth of exports is evidence of the fact that Canadian manufactured goods are giving satisfaction in outside markets as well as in the home market.

HYDRO-ELECTRIC ENERGY.

Hydro-electric energy is used extensively in Canada in flour mills, wood-working factories, cotton mills, knitting mills, and factories manufacturing woollens, carpets, gloves, shoes, shirts, collars, ready-made clothing, etc., and in other industries requiring power for the running of machinery. There are as yet very few electro-chemical and electro-metallurgical industries, but the numerous undeveloped water-powers of Canada offer such favourable opportunities for the investment of capital that great developments may be expected in the near future in the utilization of hydro-electric power for such industries.

CALCIUM CARBIDE.

One of the industries that is dependent upon hydro-electric power is the manufaeture of calcium carbide, which is produced by fusing lime and

carbon together at the temperature of the electric furnace. The process is a Canadian invention, but there are now a number of plants in countries where water-power is available. Calcium carbide is used extensively for two purposes: the production of acetylene gas and the manufacture of calcium cyanamide. There are three plants manufacturing calcium carbide in Canada: one at Shawinigan Falls on the St. Maurice river; one in Ottawa, and one at Thorold, Ontario. The world's present consumption of calcium carbide amounts to nearly 700,000,000 pounds annually. The three largest importers the year before the war were Germany, England and Australia. Considerable quantities were also imported by Portugal, Belgium and Holland. There is a rapidly growing demand in the countries of Central and South America, where it is used in the production of acetylene gas for house lighting. Uruguay alone imported 18,000,000 pounds in 1913, and large quantities were imported by Brazil, Chili, Peru and Venezuela. Cuba imported 14,000,000 pounds. African countries imported about the same quantity as Cuba. The consumption in the British West Indies is increasing. The Canadian calcium carbide industry can be expanded to meet any growth in the demand. For the fiscal year 1915 Canada's exports of calcium carbide were valued at $1,117,118.

CALCIUM CYANAMIDE.

Calcium cyanamide is manufactured on the Canadian side of Niagara Falls by causing a current of atmospheric nitrogen to pass over powdered calcium carbide made red hot in an electric furnace. The Canadian production of calcium cyanamide is at present about 48,000,000 pounds annually and is rapidly increasing to supply a growing demand. The plant has been quadrupled since the industry was started; several million dollars have been invested in it and it is declared to be a great commercial success. Nearly the whole of the product is exported. Its chief use is as a nitrogenous fertilizer, but it is also used in the production of sulphuric acid. The customs returns do not show the quantity of calcium cyanamide exported. It is included with fertilizers. The total value of Canadian fertilizers exported in 1915 was $2,539,789, but this included not only calcium cyanamide but also sulphate of ammonia produced in the by-product coke ovens of the great iron and steel plants and small quantities of other fertilizers.

NITRIC ACID AND NITRATE OF LIME.

The immense demand for nitric acid in the manufacture of explosives, dyes and sulphuric acid and in the production of fertilizers, gives great importance to the discovery that the nitrogen of the air can be cheaply utilized by electric processes in the manufacture of nitric acid, nitrate of lime and other nitrates. Nitrogen forms approximately 79 per cent by volume and 77 per cent by weight of the atmosphere. The first attempt to manufacture nitric acid from the atmosphere on a commercial scale was made at Niagara Falls by the Atmospheric Products Company, but the process used does not seem to have been particularly successful, and the first great success achieved was in Norway by means of another hydro-electric process. In Norway 340,000 horse-power is now being utilized in the manufacture of nitric acid and the various nitrates from the nitrogen

of the atmosphere, and arrangements have been made to double the capacity of the plants. The cost of producing nitric acid, nitrate of lime and nitrate of soda from atmospheric nitrogen is said to be considerably less than the cost of production from Chili saltpetre, which has heretofore been the chief source of the world's supply, while the nitric acid produced from the atmosphere is said to be purer and better, and it is stated that plants absorb nitrogen more quickly from the atmospheric nitrogenous fertilizers than from any others.

It was stated recently by a witness before a United States Senate Committee having under consideration a water-power bill that in February 1914, some months before the outbreak of the great war, the Norwegian Nitrogen Manufacturing Company received an immense order for nitric acid from Germany for use in the manufacture of ammunition and a great plant which was manufacturing nitrate of lime at the time has ever since been devoted exclusively to the manufacture of nitric acid for German ammunition. Shut off from supplies of Chilian saltpetre Germany would have had a great shortage of nitric acid, but for the supplies received from Norway. In a double sense the powers of the air have been made servants of Germany.

The same electric processes that are applied in Norway in the production of nitric acid from the atmosphere can be applied in Canada. The only raw material other than atmospheric nitrogen required in the manufacture of nitrate of lime is limestone. There are immense deposits of limestone within convenient distances from the numerous great water-powers of the St. Lawrence river and its tributaries. There is plenty of limestone between Hamilton and Niagara Falls and limestone has been found in great quantities in the vicinity of the Hudson Bay railway near enough to the water-powers of the Nelson river to be available. Canada has every natural advantage possessed by Norway for the manufacture of nitric acid and the various nitrates, while its geographical position is more favourable for the distribution of the products to the world at large.

There is already an increasing demand for fertilizers containing nitrogen both for northern soils exhausted by wheat growing and southern soils where sugar cane is grown. This demand is certain to increase as scientific methods of farming become more general. The United States alone imported over $42;000,000 worth of nitrogenous products in the year 1913, and the world's consumption is enormous.

It was recently announced that the organization of a company for the manufacture of atmospheric nitrogen products on a large scale on the Saguenay river in Quebec province is under way. It is proposed that the initial installation shall be 300,000 horse-power the whole of which is to be used in the manufacture of nitrogen products.

POTASH FROM FELDSPAR.

For a number of years the world has got its supply of potash from deposits in Bavaria, Germany, but it was stated positively by a witness before the United States Committee on Public Lands in December, 1914, that the manufacture of potash from feldspar by a recently perfected hydro-electric process would shortly be commenced in Canada. The large deposits of feldspar in Hastings county, Ontario, and in Ottawa county, Quebec,

could be utilized for this purpose if the process proves to be a commercial success.

CAUSTIC SODA.

The immense salt deposits of southwestern Ontario owing to their remarkable purity are particularly suitable for the manufacture of caustic soda, bleaching powder and other sodium products. Caustic soda was manufactured from Ontario salt on a large scale at Sault Ste. Marie, Ontario, by hydro-electric power, but the building and plant were destroyed by fire. A plant for the manufacture of caustic soda and bleaching powder has recently been erected at Sandwich, Ontario. It has the advantage of having the material right at hand.

NEW DISCOVERIES AND INVENTIONS.

New discoveries and inventions and improvements of old inventions for the utilization of hydro-electric power in chemical processes are constantly being made. With abundance of raw materials and cheap hydro-electric power Canada should be able to supply a large part of the world's demand for such products.

MANUFACTURE OF ALUMINUM.

Hydro-electric power generated at the Shawinigan fall of the St. Maurice river is used in the manufacture of aluminum which is produced by electrolyzing alumina or concentrated bauxite dissolved in a molten bath of cryolite. At present the concentrated bauxite must be imported from France or from the United States as no important deposits of bauxite have been found in Canada, but as new mineral discoveries are constantly being made in Canada, it may not always be necessary to import this mineral. Cryolite, the other material used, is a mineral found only in Greenland and formerly supposed by the natives to be a peculiar kind of ice as it occurs in snow white masses and melts very easily even in candle flame. Artificial cryolite is now produced in France and Austria from fluorspar and is said to be superior to the natural cryolite of Greenland. As there are large deposits of flourspar in Hastings county, Ontario, artificial cryolite might be produced in Canada. For the fiscal year 1915 the exports of aluminum in bars, blocks, etc., were valued at $2,318,800. There are factories in Ottawa and at Oakville, Ontario, manufacturing aluminum ware from aluminum made at Shawinigan.

LEAD REFINING.

At Trail, British Columbia, an electrolytic process is used in refining the products of the lead blast furnaces. Pig lead, fine gold, fine silver, copper sulphate, refined antimony and babbit metal are produced.

OTHER ELECTRO-METALLURGICAL INDUSTRIES.

Ferro-silicon is being manufactured on a small scale with an electric furnace at Sault Ste. Marie Ontario, and on a much larger scale at Welland, Ontario, where Niagara Falls power is used. Various experiments have been made in Canada in the reduction of nickel, copper and zinc in electric furnaces with partial success and both iron and steel have been

successfully made in small experimental electric furnaces, but none of these electro-metallurgical industries has been undertaken on a commercial scale in Canada as yet.

ORDINARY CHEMICAL INDUSTRIES.

Apart from the hydro-electric chemical industries Canada has a number of other chemical industries. Most of them were established to supply the home market but some of them have now reached the exporting stage. The exports of Canadian chemicals, drugs and medicines not included in the account of hydro-electric chemical industries were valued at $2,657,866 in 1915 and will steadily increase. Among the chemical exports were acetate of lime valued at $269,591, sulphuric acid valued at $41,335, phosphorus valued at $84,458, extract of hemlock valued at $41,335, lye valued at $110,000 and wood alcohol valued at $231,283. A number of chemicals are produced from the tar at the by-product coke ovens of the steel plants. The sulphate of ammonia produced at the by-product coke ovens has already been referred to in connection with the exports of fertilizers. Toronto claims to have the largest plant for the manufacture of ammonia in the British Empire. Among the products is anhydrous ammonia, which is largely used in the manufacture of artificial ice. There are a number of other ammonia manufacturers in Canada.

The manufacture of medicinal drugs has reached a high stage of perfection in Canada. There were 40 establishments manufacturing drugs, with a capital investment of $5,870,991, in 1910, and the year's output was valued at $3,632,794. There were 37 patent medicine manufacturers, with a capital investment of $3,014,652. Their products for the year were valued at $3,214,939.

There were eleven establishments, with a capital investment of $1,651,375, making starch in 1910, and the year's output was valued at $1,744,381.

THE MANUFACTURE OF EXPLOSIVES.

In 1910 there were seven establishments in Canada devoted to the manufacture of explosives chiefly used for peaceful purposes in the development of the country. The products were valued at $2,168,500. During the fiscal year 1914 gunpowder and other explosives valued at $241,665 were exported; for the fiscal year 1915 the value was $486,715. The manufacture of toluol was started at the by-product plant of the Dominion Iron and Steel Company at Sydney after the war began.

WAR AMMUNITION.

The war brought about the manufacture of great quantities of ammunition, and the statistics for the fiscal year 1916 will show very large exports.

PAINTS, COLOURS AND VARNISHES.

In 1910 there were twenty-six establishments making paints, colours and varnishes in Canada. The product was valued at $8,041,154. Paints and varnishes of very superior quality are manufactured, and an important export business is likely to develop. The value of exports in 1915 was $190,198. Canada has great natural advantages for the manufacture of

paints, because large quantities of flaxseed oil are produced in the country from Canadian-grown flaxseed and there are numerous deposits of good mineral pigments. Mr. C. W. Willimott, of the Canadian Geological Survey, made a special study of the mineral pigments of Canada, and his monograph on the subject shows that Canada is peculiarly rich in mineral pigments of superior quality.

BLACKING, INKS AND GLUES.

Thirteen establishments with a capital investment of $450,132, were making blacking in 1910, and the year's output was valued at $691,029. There were twelve ink factories, with a capital investment of $486,093, and an output valued at $568,255; while eight factories, with a capital investment of $818,241, made glue valued at $584,766.

SOAP AND WASHING COMPOUNDS.

There were twenty-two soap factories in 1910; the capital investment was $5,587,221 and the year's products were valued at $5,220,546. Seven factories, with a capital investment of $191,231, made washing compounds, the value of the year's output being $282,874.

GRAPHITE INDUSTRIES.

In graphite manufacture there was a capital investment of $221,300 in three establishments. The output was valued at $112,407 in 1910 according to the census.

LEAD PRODUCTION.

The production of refined lead from Canadian ores, including pig lead and lead pipe, amounted to 36,413,821 pounds in 1913, the latest year for which statistics are available. The electrolytic refining plant at Trail, B.C., has been referred to, but part of the lead produced in Canada has been treated by ordinary processes in a plant at Kingston, Ontario.

SMELTING AND REFINING OF NICKEL, COPPER AND ZINC.

Great opportunities await the investment of capital in the refining of nickel, copper and zinc in Canada. It has been shown that Canada has the greatest nickel mines in the world and it also produces large quantities of copper and zinc. The nickel-copper ores of Ontario are smelted into a matte at Sudbury, but the refining is done in the United States. There are also large copper smelters in British Columbia, but the matte is shipped to the United States. In 1913, the latest year for which statistics are available, 7,074 tons of zinc concentrates containing 5,941,727 pounds of zinc, were shipped to the United States refineries. The Ontario Government is now making an inquiry to ascertain the best means of securing the establishment of a nickel refining industry in the province.

MILLING THE SILVER ORES OF COBALT.

A considerable proportion of the ore mined in the Cobalt district of Ontario is milled near the mines. Cobalt ores are also treated in reduction plants at Thorold, Ontario, and Deloro, Ontario.

BABBITT METAL.

In 1910 there were six establishments making babbitt metal; the capital invested was $920,548 and the output was $1,016,699.

ASBESTOS MANUFACTURES.

Although Canada supplies the greater part of the world's demand for asbestos, most of the exports are unmanufactured. Exports of asbestos were valued at $2,891,669 in 1914 and at $2,227,387 in 1915, while exports of asbestos manufactures were valued at $98,244 during the fiscal year 1914 and at $78,239 during the fiscal year 1915. In 1910, according to the census, there were nine establishments manufacturing asbestos, with a capital investment of $586,000 and an output for that year valued at $35,190. While asbestos exports are referred to as manufactured and unmanufactured, very little asbestos in an absolutely crude state is exported. Every asbestos mine of importance in the asbestos district of Quebec province is equipped with a complete milling and fiberizing plant. The greater part of the asbestos exported is in the form of asbestos fibre. The principal mines and mills are at Thetford, Black lake and East Broughton and vicinity. Both mines and mills are run by hydro-electric power.

There are a great variety of manufactures of asbestos, and its uses are constantly increasing for purposes for which fireproof and insulating materials are required. Asbestos cloth is very extensively used in the manufacture of theatre curtains and theatrical scenery and sometimes for covering the walls of theatres. Nearly all the asbestos theatre curtains in the world are made of fibre from the Thetford Mines.

It is manufactured into ornamental wall, ceiling and floor coverings. Some of the leading hotels of New York have asbestos floor coverings. Large quantities of asbestos are used in the manufacture of pipe coverings. Asbestos piston-rod packing made of long fibre asbestos spun into strands is used extensively on warships. Great quantities of asbestos millboard are used in the stove industry for lining oven doors. Asbestos sheeting papers are used between floors and walls and in roofing, not only as a protection against fire but because an asbestos sheeting between walls prevents sounds passing from room to room. There is a great and increasing demand for asbestos roofing slates. Asbestos roofing slate is manufactured at Lachine, Que., from asbestos mined at Thetford and Black Lake. Asbestos roofings and wall coverings are said to have the remarkable quality of keeping out heat in the tropics and cold in the northern zone. In the tropics asbestos roofing slate is coming into use as a substitute for corrugated iron roofing. Mr. Fritz Cirkel, M.E., says of asbestos cement slate: "This is practically indestructible by atmospheric influences, so that maintenance expenses for roofs covered with this material are excluded. For a period of three months the asbestos cement slate absorbs and assimilates moisture in exactly the same ratio as the best natural slate. After that time the absorption ceases altogether, and the material becomes impervious, indestructible and as hard as iron. The stringy asbestos fibres which, by the characteristic peculiarity of a patented process, are embedded crosswise in the cement paste, have exactly the same effect as

concrete-steel constructions. They impart to the asbestos slate extremely high physical strength, indifference to blow and shock, and great elasticity, which properties are of the same importance to conveyance and the laying of the asbestos slates as they are to their durability and length of service."

Asbestos has been found particularly suitable for use in the construction of cold chambers on ships, and in cold storage buildings, owing to its non-conducting properties. It is used extensively as a filtering medium in laboratories. When there is a tenacious residue after filtering the asbestos filter can be thrown into the fire and when the residue matter has been consumed the asbestos filter can be used again as it is uninjured by the fire. Asbestos twine is used in laboratories to bind together parts of apparatus exposed to fire and strong acids. A number of household articles and especially kitchen articles are made out of asbestos. Fibre felts made of pure asbestos fibre are used in large quantities for insulating the heat radiating surfaces of automobiles, the insulation of electric service wires and the manufacture of sad iron holders, etc.

Patents have been taken out for a variety of inventions in which asbestos is used in combination with other materials for fireproofing and insulating purposes.

GLASS MANUFACTURES.

There were nine establishments manufacturing glass in Canada in 1910; the capital investment was $2,521,000 and the year's output was valued at $2,269,158. Glassware and glass bottles are extensively made.

There were also 21 establishments making stained, cut and ornamental glass with a capital investment of $526,069 and an output valued at $1,006,266 and 15 making mirrors and plate glass with a capital investment of $904,200 and an output for the year valued at $897,972. The exports of Canadian glass and glassware during the fiscal year 1914 were valued at $34,453 and went to 19 countries.

BRICK, TILE AND POTTERY.

In 1910 there were 399 establishments making brick, tile and pottery; the capital investment was $14,782,226 and the year's output was valued at $8,291,561. Canadian earthenware to the value of $13,012 and other Canadian clay manufactures to the value of $36,628 were exported in 1914 going to 14 countries.

CEMENT INDUSTRIES.

There were 21 establishments manufacturing Portland cement in 1910; the capital investment was $17,114,255 and the year's output was valued at $5,683,036. Eighty-four establishments were making cement blocks and tiles, the capital investment being $1,321,600, and the value of the year's output $2,269,158. Exports of cement were valued at only $2,393 in 1914 and $1,065 in 1915.

IRON AND STEEL.

In 1914 there were 22 iron blast furnaces in Canada, having a daily capacity of about 4,440 tons as follows: The Dominion Iron and Steel Company, Sydney, Nova Scotia, six furnaces with a capacity of 1,680 tons

daily; the Nova Scotia Steel Company of New Glasgow, Nova Scotia, one furnace of 200 tons daily capacity at Sydney Mines; the Algoma Steel Company of Sault Ste. Marie, Ontario, three furnaces with a total capacity of 950 tons daily; The Steel Company of Canada, two furnaces at Hamilton, Ontario, with a total capacity of 500 tons daily; the Canadian Furnace Company, Port Colborne, Ontario, one furnace of 300 tons daily capacity; the Standard Iron Company of Canada, Deseronto, Ontario, one charcoal furnace at Deseronto with a daily capacity of 112 tons and one at Parry Sound, Ontario, with a daily capacity of 84 tons; the Atikokan Iron Company, Port Arthur, one furnace of 100 tons daily capacity; the Canada Iron Corporation two furnaces at Midland, Ontario, with a total capacity of 375 tons daily, one furnace at Radnor Forges, Quebec, with a capacity of 25 tons daily, and two at Drummondville, Quebec, with a capacity of 15 tons daily; the Londonderry Iron and Mining Company, Londonderry, Nova Scotia, one furnace of 100 tons daily capacity. The blast furnaces at Deseronto, Parry Sound, Radnor Forges and Drummondville use charcoal as fuel. All the others use coke.

The Dominion Iron and Steel Company, the Nova Scotia Steel Company, the Steel Company of Canada and the Algoma Steel Company turn their pig iron into finished steel products. The other companies manufacture only pig iron. The companies manufacturing finished steel products find a more certain market for their output both at home and abroad and are able to operate their plants more continuously. Some of the plants manufacturing pig iron exclusively have recently been idle. Exports of pig iron amounted to 9,310 tons in 1914.

Iron and steel manufacture is a comparatively new industry in Canada. Industries using imported iron and steel as materials had reached a high stage of development before the manufacture of these materials was established on a permanent basis in Canada although several attempts at manufacturing pig iron were made on a small scale in earlier years.

The production of pig iron was 1,128,967 tons in 1913 and 783,164 tons in 1914. The production of steel ingots and castings was 1,168,993 tons in 1913 and 814,415 tons in 1914. Steel rails are produced in large quantities at the works of the Dominion Iron and Steel Company, Sydney, Nova Scotia, and by the Algoma Steel Company at Sault Ste. Marie, Ontario. Considerable quantities of steel rails have been exported from Sydney, but ordinarily the greater part of the output of the mills is used on Canadian railways. Canada's production of pig iron in 1913 was more than twice as great as the production of pig iron in the United States in the year 1850 when the population was 23,191,876. In 1880 when the population of the United States was over fifty millions the production of steel was 1,247,335 tons as compared with 1,168,993 tons in Canada in 1913. Canada now ranks eighth among the iron and steel producing countries of the world.

IRON AND STEEL BRIDGES.

Eleven establishments were making iron and steel bridges and structural steel in 1910; the capital invested was $5,781,898 and the year's output was valued at $6,502,410. In the development of Canada by the construction of railways and highways almost all possible conditions of bridge

building have been met with and the experience gained by Canadian bridge builders under a great variety of circumstances should fit them to undertake the manufacture and erection of bridges for other countries.

AGRICULTURAL IMPLEMENTS.

One of the most important industries of Canada is the manufacture of agricultural implements. Canadian implement manufacturers have been successful not only in Canada but in many outside markets. In 1910 there were 77 establishments making agricultural implements. The capital invested was $45,232,098 and the year's output was valued at $20,722,722. The value of exports of Canadian agricultural implements was $6,152,559 during the fiscal year 1913 and $7,219,520 during the fiscal year 1914, without including threshing machines, but in the fiscal year 1915 the value of Canadian agricultural implements exported was only $2,802,096, owing to the outbreak of war in a number of countries that ordinarily import agricultural implements from Canada. Among the agricultural implements exported were cultivators, seed drills, harrows, harvesters and binders, mowing machines, ploughs, reapers, etc. The exports of Canadian threshing machines were valued at $712,270 in 1914 and at $866,993 in 1915.

Among the countries importing agricultural implements from Canada were the following: the United Kingdom, France, Italy, Austria-Hungary, Germany, Belgium, Holland, Denmark, Norway, Sweden, Russia-in-Europe, Russia-in-Asia, Turkey-in-Europe, Turkey-in-Asia, Greece, Rumania, Servia, Spain, Portugal, Cuba, Chili, Peru, Uruguay, Argentina, Brazil, Newfoundland, Australia, New Zealand, British India, British West Indies, British Straits Settlements, British South Africa, British East Africa, French Africa, Portuguese Africa, and the United States of America. In short it may be said that Canadian agricultural implements are sold everywhere in the world in peace times, and the success that has been achieved in selling this line of Canadian manufactures is an indication of what may be achieved in other lines when attention is devoted to the development of an export business.

CREAM SEPARATORS.

Cream separators made in Canada were exported to five countries in 1914. The value was $17,000.

SAWS, AXES, HAMMERS, TOOLS AND GENERAL HARDWARE.

According to the census returns there were in 1910 thirty establishments manufacturing axes and tools, eleven making saws, eight making dies and moulds, four producing carriage and saddlery hardware, and eight making scales. A high degree of excellence has been reached in the manufacture of tools. Canadian tools were exported to twenty-six countries in 1914. The value of exports was $106,617. Other Canadian hardware to the value of $94,702 was exported to twenty countries. Hammers, files, wire nails, screws, hinges, latches, locks and many other articles of hardware are exported. Canadian saws are made to cut every class of timber, even the hardest woods of the tropical forests. It is only necessary to know the character of the timber to be cut and saws are manufactured to suit the case.

CANADIAN TYPEWRITERS AND LINOTYPE MACHINES.

Canadian typewriters were exported to ten countries in 1914. The value of exports was $204,502. The United Kingdom was the largest purchaser. Linotype machines of Canadian manufacture were sold in six countries.

SEWING MACHINES.

Sewing machines made in Canada were exported to seventeen countries in 1914. The value of exports was $98,648.

WASHING MACHINES AND WRINGERS.

Washing machines and wringers of Canadian manufacture were sold in fifteen countries in 1914. The value of exports was $27,504.

FOUNDRY AND MACHINE SHOP PRODUCTS.

There were 514 foundries and machine shops operating in Canada in 1910, according to the census of 1911. The capital invested in them was $53,068,046, and the products for one year were valued at $45,611,416. They were mostly sold in the home market. There are a number of very large stove and furnace foundries, but the exports of stoves are small. In 1914 the value of stoves exported was $20,618. Machinery manufactures include machinery for factories and mills, mining machinery, hoisting machinery and roadmaking machinery. Exports of general machinery made in Canada were valued at $444,456 in 1914 and $351,067 in 1915.

GAS BUOYS.

Gas buoys and their parts to the value of $18,832 were exported to thirteen countries in 1914.

BOILERS, ENGINES AND GAS MACHINES.

There were 71 establishments making boilers and engines in 1910. The capital investment was $14,063,990 and the output was valued at $11,873,903. There were 16 establishments making gas machines with a capital investment of $425,740 and an output valued at $731,120. Gasolene engine exports were valued at $116,607 during the fiscal year 1915.

The manufacture of fire engines and other fire fighting appliances has become an important industry.

SAFES AND VAULTS.

The manufacture of safes and vaults is one of the oldest of Canadian industries. There were three establishments making them in 1910, with a capital investment of $793,000 and an output valued at $460,070.

WIRE AND WIRE FENCING.

Thirteen establishments were making wire in 1910. The capital investment was $2,815,888 and the output was valued at $2,608,907, while ninteen establishments were manufacturing wire fencing, with a capital investment of $2,059,679 and an output of $2,608,907.

AUTOMOBILES, BICYCLES, CARRIAGES AND WAGONS.

According to the census returns there were eight establishments manufacturing automobiles, with a capital investment of $4,699,256 and an output valued at $6,251,885 in 1910; four making bicycles, with a capital investment of $68,000 and an output valued at $72,179; while 324 were making carriages, wagons and carriage and wagon parts, with a capital investment of $35,505,641 and an output in 1910 valued at $14,939,534. Exports of Canadian automobiles and parts were valued at $3,807,719 during the fiscal year 1914 and at $3,054,453 in 1915. Exports of Canadian bicycles were valued at $8,255 in 1914 and at $10,648 in 1915. Exports of carriages and carriage parts were valued at $71,919 during the fiscal year 1914 and $47,965 during the fiscal year 1915.

GUNS, RIFLES AND FIREARMS.

The manufacture of guns, rifles and firearms has become quite an important industry. During the fiscal year ended March 31, 1914, the exports were valued at $130,568 and during the fiscal year 1915 at $211,324. Exports of Canadian-made cartridges for guns, rifles and pistols were valued at $13,333 in 1914.

EXPORTS OF IRON AND STEEL GOODS NOT SPECIFIED.

There are a great variety of iron and steel goods exported that are not classified separately in the Customs reports. Usually the quantities exported are small, but the total value of such exports during the fiscal year 1914 was $968,074 and included exports to forty countries. In many cases Canadian manufacturers who are devoting their attention to supplying the home market receive unsolicited orders from abroad. The amount may be small but it often represents the beginning of an export trade that will grow to be important later on. Such occasional orders from abroad sometimes arouse the interest of a Canadian manufacturer in the foreign market and lead to systematic efforts to develop an export business. What is true in this regard of articles made of iron and steel is true also of many other lines of manufactures.

BRASS AND IRON BEDSTEADS.

There were eight establishments making brass and iron bedsteads in 1910; the capital investment was $1,044,264 and the value of the year's product was $1,202,550.

METALLIC ROOFING AND FLOORING.

Seven establishments with a capital investment of $2,148,426 were making metallic roofing in 1910. The value of the year's output was $1,874,238. The exports of metallic shingles and laths and corrugated roofing of Canadian manufacture were valued at $377,012 in 1914.

PLUMBERS' SUPPLIES.

Seventeen establishments were engaged in the manufacture of plumbers' supplies in 1910. The capital investment was $2,563,136 and the year's products were valued at $2,283,630.

BRASS CASTINGS.

There were 36 establishments making brass castings in 1910; the capital investment was $3,000,762 and the year's output was valued at $3,093,006.

RAILWAY CARS AND LOCOMOTIVES.

According to the census there were 15 establishments making cars in 1910. The capital investment was $22,366,123 and the year's output was valued at $16,630,634, while 114 establishments with a capital investment of $5,801,063 made car repairs to the extent of $31,817,883. There are four establishments making locomotives, one in Montreal, one in Toronto, one in Kingston, Ontario, and one in St. John, New Brunswick.

ELECTRICAL APPARATUS AND SUPPLIES.

There were 47 establishments manufacturing electrical apparatus and supplies; the capital investment was $17,293,354, and the products for the year were valued at $15,021,841. The exports of Canadian electrical apparatus were valued at $106,816 during the fiscal year 1914 and $97,890 during the fiscal year 1915.

MATTRESSES AND SPRING BEDS.

There were 52 factories making mattresses and spring beds in 1910; the capital investment was $1,689,414, and the year's output was valued at $2,932,051.

MUSICAL INSTRUMENTS.

Canadian pianos and organs have a high reputation both at home and abroad. Almost every Canadian home has a piano or organ made in Canada and Canadian church organs are noted for their superior qualities.

In 1910 there were 42 establishments making musical instruments and eight making parts of musical instruments. The capital invested in these industries was $7,495,953 and the year's output was valued at $7,041,406. Exports of Canadian organs and pianos were valued at $196,028 in 1914 and $124,737 in 1915; exports of other musical instruments made in Canada were valued at $86,679 in 1914 and $100,829 in 1915.

VESSELS AND PLEASURE BOATS.

Forty-three establishments were building and repairing ships in 1910. The amount of capital invested was $9,033,448 and the year's output was valued at $5,136,257. The number of establishments making boats and canoes was 126; the capital invested was $1,285,117 and the output was valued at $1,417,210. The many rivers and lakes in Canada offer unequalled facilities for pleasure boating. The experience and skill required in constructing a great variety of pleasure boats for the Canadian home market would enable Canadian manufacturers to suit the demand for pleasure boats in any foreign market. Gasoline launches to the value of $9,515 were exported in 1914.

BROOMS, BRUSHES AND WHISKS.

Thirty-five establishments were making brooms and brushes in 1910. The capital investment was $1,404,568 and the year's output was valued

at $1,731,523. The value of brooms, brushes and whisks exported in 1914 was $29,720. Shipments were made to eighteen countries.

VACUUM CLEANERS.

Four factories made vacuum cleaners in 1910. The capital investment was $56,700 and the value of the year's output was $44,282. No exports were recorded in the Customs report.

LEATHER AND ITS PRODUCTS.

There were 113 establishments making tanned, curried, and finished leather in 1910; the capital investment was $17,068,768 and the year's products were valued at $19,972,178.

The leather boot and shoe factories numbered 180 with a capital investment of $23,630,649 and the year's product was valued at $33,987,248, while 14 establishments with a capital investment of $961,319 were making boot and shoe supplies, the year's output being valued at $1,025,878. Fifty-seven establishments made harness and saddlery; the capital investment was $4,866,192 and the output was valued at $5,205,454. There were three whip factories with a capital investment of $94,000 and an output valued at $124,350. Thirty-two factories with a capital investment of $2,167,875 made other leather goods not specified with an annual output valued at $2,535,304. Exports of Canadian leather and leather goods during the fiscal years 1914 and 1915 were as follows:—

	Fiscal Year 1914.	Fiscal Year 1915.
Sole leather	$2,336,491	$4,096,081
Upper leather	113,916	1,450,910
Other leather unmanufactured	617,179	1,014,490
Leather boots and shoes	82,529	188,084
Other leather manufactures	63,826	4,057,724

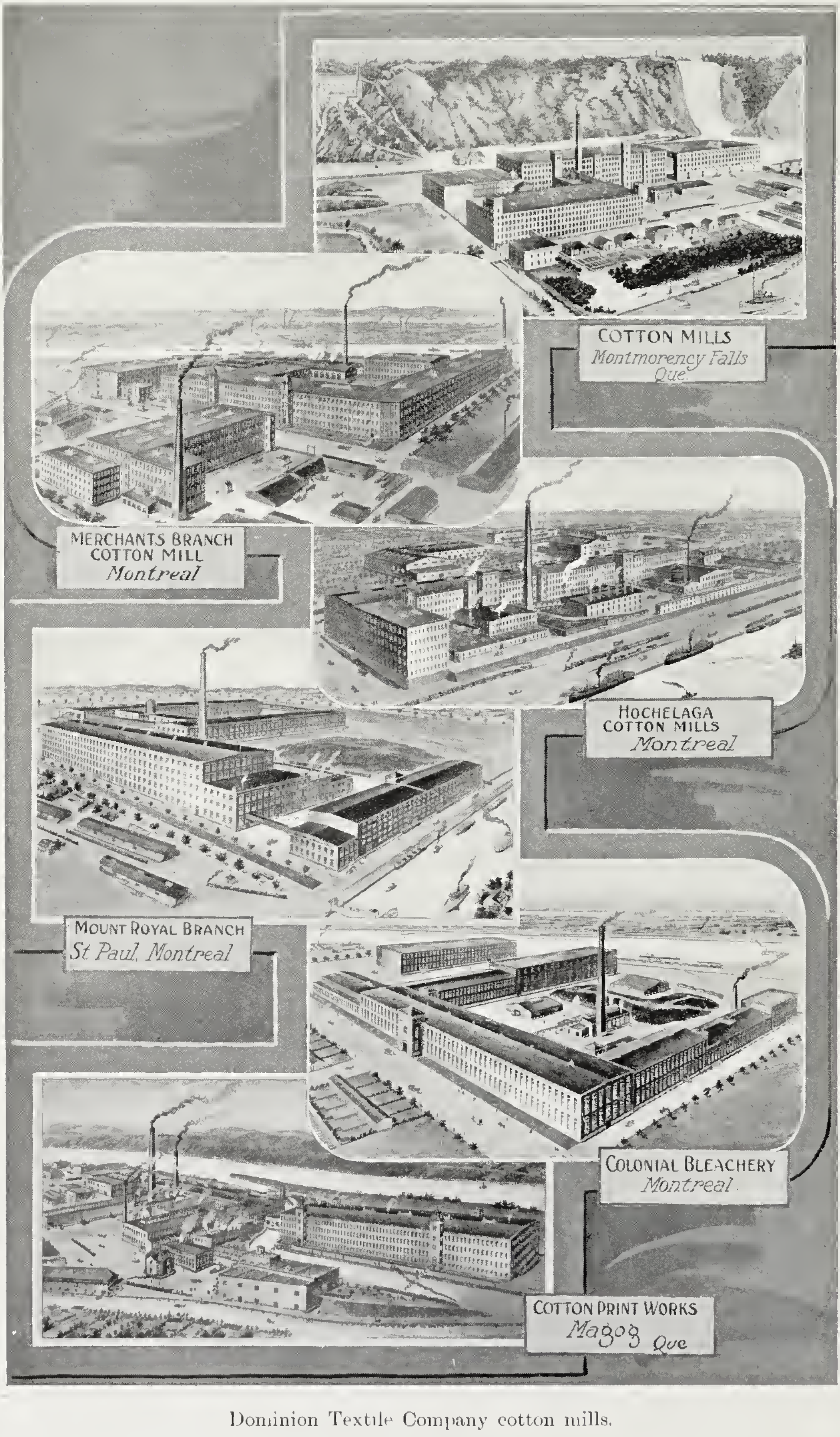
The United Kingdom is the largest importer of Canadian leather, taking leather to the value of $1,820,504 during the fiscal year 1914 and $3,870,608 during the fiscal year 1915, but shipments of leather were made to eleven countries during the fiscal year 1914. Canadian boots and shoes were exported to eleven countries and Canadian saddlery and harness to ten countries in 1914.

GLOVES AND MITTENS.

Although gloves and mittens are largely made of leather, they are not included among the leather manufactures. There were thirty-five establishments making gloves and mittens in 1910, with a capital investment of $1,908,675, and the year's output was valued at $2,995,356. There do not appear to have been any exports of gloves and mittens in 1914 and 1915.

RUBBER AND ELASTIC GOODS.

In 1910 there were twenty-eight establishments making rubber and elastic goods, with a capital investment of $5,133,847, and an output for the year valued at $7,039,201, including seventeen establishments making rubber clothing, with a capital investment of $676,685, and an output valued at $1,189,930. The exports were valued at $686,231 in 1914 and



Dominion Textile Company cotton mills.

$722,905 for the fiscal year 1915, and went to thirteen countries. The lines most largely exported were rubber boots and shoes, rubber clothing, rubber hose and rubber belting.

COTTON FABRICS.

There were twenty-six cotton mills in 1910, with a capital investment of $33,091,344. The year's output was valued at $24,584,931. During the fiscal year 1914 cotton fabrics valued at $82,636 were exported, being shipped to twenty countries. Other cotton goods to the value of $24,591 were shipped to thirteen countries.

CORDAGE, ROPE AND TWINE.

Nine factories manufactured cordage, rope and twine in 1910. The capital investment was $4,314,411, and the year's output was valued at $3,624,113. The exports were valued at $513,657 in 1914 and $1,124,201 in 1915.

DRESSED FLAX AND LINEN.

Thirty establishments, with a capital investment of $421,389, dressed flax, the year's output being valued at $548,559. Three, with a capital investment of $334,000, manufactured linens valued at $299,000.

THREAD.

There were three establishments making thread in 1910, with a capital investment of $935,000, and an output for the year valued at $1,096,000.

AWNINGS, TENTS AND SAILS.

Twenty-six establishments, with a capital investment of $1,086,240, made awnings, tents and sails, the value of the output being $1,342,436 in 1910. The exports were valued at only $1,692 in 1914.

COTTON BAGS.

There were ten cotton bag factories, with a capital investment of $2,786,343, in 1910. The year's output was valued at $5,722,478.

CARPETS, MATS AND RUGS.

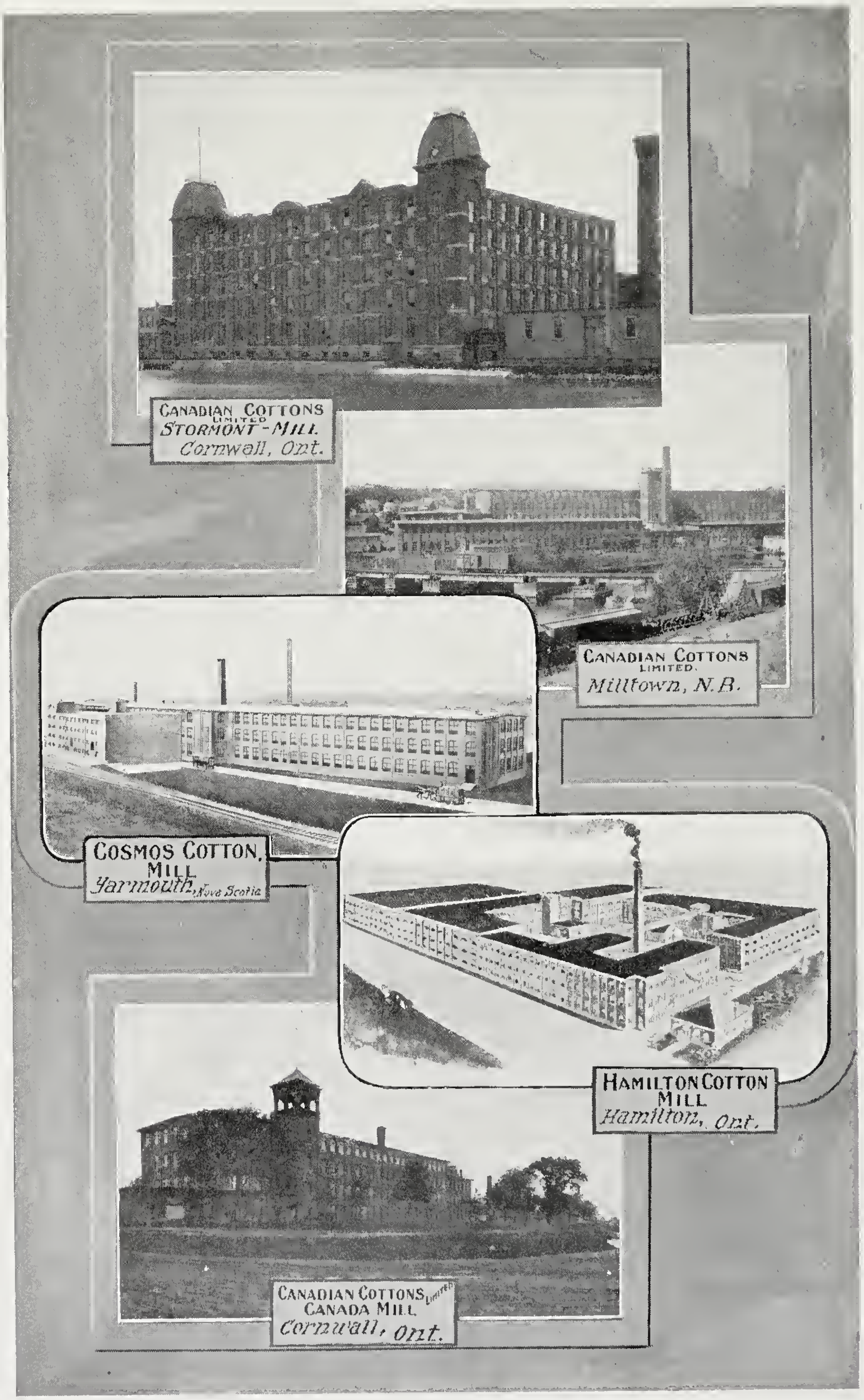
There were six carpet factories, with a capital investment of $2,037,487, in 1910. The year's output was valued at $1,971,500. Seven factories made mats and rugs, the capital investment being $106,269, while the output was valued at $112,673.

BLANKETS.

Four factories made blankets and sweat pads. The capital investment was $309,966, and the products were valued at $167,688 in 1910.

HOSIERY AND KNIT GOODS.

Sixty-eight establishments made hosiery and knit goods in 1910. The capital investment was $11,938,029, and the year's product was valued at $13,393,854.



Another group of Canadian cotton mills.

WOOLLEN FABRICS.

Eighty-seven factories made woollen goods in 1910. The capital investment was $7,657,761, and the output was valued at $5,738,773. In wool pulling, carding and fulling, forty-two establishments had a capital investment of $294,900, and their products were valued at $541,837 in 1910.

SILK AND SILK GOODS.

In the manufacture of silk and silk goods there was a capital investment of $1,378,678 in four factories, and the output was valued at $1,009,476 in 1910. Exports of silk goods were valued at $26,880 in 1914 and $30,933 in 1915. Australia was the largest importer.

HATS, CAPS AND FURS.

There were 139 establishments engaged in the manufacture of hats, caps and furs in 1910. The capital investment was $10,653,627, and the output for the year was valued at $11,155,102. Canadian hats and caps were exported to eleven countries during the fiscal year 1914. The value of the exports was $21,521. For the fiscal year 1915 the exports of hats and caps were valued at $16,203.

FACTORY-MADE CLOTHING.

There were 225 factories, with a capital investment of $11,492,654, making men's clothing in 1910, and the value of products was $25,020,865, while ninety-three factories, with a capital investment of $5,671,105, made women's clothing valued at $15,083,345. During the fiscal year 1914 Canadian clothing and wearing apparel was exported to thirty-two countries. The value of exports was $446,524. During the fiscal year 1915 the value of exports of Canadian clothing and wearing apparel increased to $7,344,388.

MEN'S FURNISHINGS.

In the manufacture of men's furnishings, $3,659,916 was invested in 1910. There were fifty-three factories, and the year's output was valued at $6,964,137.

CORSETS AND SUPPLIES.

Eleven factories made corsets and corset supplies in 1910. The capital investment was $1,066,678, and the year's products were valued at $1,572,106.

BUTTONS AND COMBS.

Small quantities of Canadian buttons are exported. There were seven button factories in 1910, with a capital investment of $425,600. The year's output was valued at $407,000. In the manufacture of combs, $126,250 was invested in seven factories in 1910, and the year's output was valued at $186,966.

FRINGES, CORDS AND TASSELS.

Four factories were making fringes, cords and tassels in 1910. The capital investment was $88,000, and the year's output was valued at $98,000.

FANCY GOODS AND FEATHER GOODS.

Five establishments with a capital investment of $183,100 made fancy goods valued at $240,100 in 1910. There was a capital investment of $220,-283 in four feather goods factories, the output for 1910 being valued at $339,617.

JEWELLERY INDUSTRIES.

Fifty-eight establishments were engaged in making and repairing jewellery in 1910. The capital invested was $4,036,902 and the value of the products for the year was $3,142,272. Canadian jewellery to the value of $113,589 was exported in 1914, going to 25 countries.

DRESSED FURS.

Six establishments with a capital investment of $198,500 dressed furs in 1910. The value of the output was $1,973,000. The exports of dressed furs were valued at only $11,550 during the fiscal year 1914, while undressed furs valued at $5,557,926 were exported that year. In 1915 there was a big falling off in the exports of furs the value of furs and manufactures of furs exported being only $2,799,205.

UMBRELLAS.

There were seven umbrella factories in 1910; the capital investment was $269,000 and the value of the year's product was $609,500.

TOBACCO, CIGARS AND CIGARETTES.

In the manufacture of tobacco, cigars and cigarettes there was a capital investment of $21,659,935 in 1910. There were 173 factories and the year's output was valued at $25,329,323.

ALE, BEER, WHISKEY AND WINES.

In the manufacture of ale, beer, whiskey, wines and other liquors $39,367,752 was invested in 1910. There were 132 establishments manufacturing these liquors and the year's products were valued at $26,128,552.

AERATED AND MINERAL WATERS.

In the manufacture of aerated and mineral waters $3,870,005 of capital was invested. There were 128 factories and the year's product was valued at $2,808,230.

The wood manufactures and the food manufactures are described in separate chapters.

Chapter XVI.

FOREST PRODUCTS AND WOOD MANUFACTURES.

The timber areas of Canada and the kinds of trees that are most numerous have been described in the chapters devoted to the different provinces and territories. It has been shown that in Ontario the timber most largely cut into lumber is white pine, with hemlock, red pine, spruce and maple following in order of quantities, that in Quebec province spruce leads with white pine, hemlock, birch and balsam fir following, while in the Maritime Provinces spruce ranks first with hemlock, white pine, balsam fir and birch following. In Manitoba, Saskatchewan and Alberta spruce leads with tamarack and jack pine following. In British Columbia the cut of Douglas fir exceeds that of all other woods combined. Tamarack, cedar, spruce, yellow pine, hemlock, white pine and balsam fir follow in order of quantities cut. The largest saw-mills in Canada are located in British Columbia. In all the provinces excepting Ontario and British Columbia the cut of spruce exceeds the cut of all other woods.

Douglas fir (*Pseudotsuga mucronata*) grows only in British Columbia and the western part of Alberta.

White spruce (*picea canadensis*) grows in all the provinces; red spruce (*picea rubra*) in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario; black spruce (*picea mariana*) in all the provinces; Engelmann spruce (*picea Engelmanni*) in British Columbia and Alberta; Sitka spruce (*picea sitchensis*) in British Columbia.

White pine (*Pinus strobus*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba; western white pine (*pinus monticola*) in British Columbia only.

Red or Norway pine (*pinus resinosa*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba.

Eastern hemlock (*Tsuga canadensis*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario; western hemlock (*tsuga heterophylla*) in British Columbia only.

White cedar (*thuja occidentalis*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba; western red cedar (*thuja plicata*) in British Columbia only.

Tamarack (*larix laricina*) grows in all the provinces; western larch (*larix occidentalis*) in British Columbia only.

Yellow birch (*Betula lutea*) grows in Prince Edward Island, Nova Scotia, New Brunswick Quebec and Ontario; sweet birch (*Betula lenta*) in Nova Scotia, New Brunswick, Quebec and Ontario; paper birch (*Betula alba* var. *papyrifera*) in all the provinces; western birch (*Betula occidentalis*) in British Columbia only.

Sugar maple (*Acer saccharum*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario; silver maple (*Acer sacchar-*

Example of Douglas Fir as structural material in reception room, C.P.R. dock, Vancouver.

A stand of Douglas Fir 300 to 400 years old.

inum) in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario; red maple (*Acer rubrum*) in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario; broad-leaved maple (*Acer macrophyllum*) in British Columbia only.

Balsam fir (*Abies balsamea*) grows in all the provinces except British Columbia; mountain fir (*Abies lasiocarpa*) in British Columbia and western Alberta; amabilis fir (*Abies amabilis*) in the British Columbia Coast region; lowland fir (*Abies grandis*) in the British Columbia Coast region.

Western yellow pine (*Pinus ponderosa*) grows only in British Columbia.

Basswood (*Tilia americana*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario.

Jack pine (*Pinus banksiana*) grows in all the provinces east of British Columbia; lodgepole pine (*Pinus murrayana*) in Alberta only.

White elm (*Ulmus americana*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario, and occasionally in Manitoba and Saskatchewan; rock elm (*Ulmus rocemosa*) in Ontario and Quebec; red elm (*Ulmus fulva*) in Ontario and Quebec.

Beech (*Fagus grandifolia*) grows in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario.

Aspen poplar (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*) grow in all the provinces; cottonwood poplar (*Populus deltoides*) *et al. sp.*) grows in Quebec, Ontario, Manitoba, Saskatchewan and Alberta; black cottonwood poplar (*Populus trichocarpa*) grows only in British Columbia.

White ash (*Fraxinus americana*) grows in all the provinces east of Manitoba; black ash in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba.

White oak (*Quercus alba*) grows in Ontario and Quebec; red oak (*Quercus rubra*) in Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario; black oak (*Quercus velutina*) in Ontario; scrub oak (*Quercus macrocarpa*) in New Brunswick, Nova Scotia, Quebec, Ontario and Manitoba.

Hickory, chestnut, butternut, walnut and cherry are cut in small quantities in Ontario and Quebec, while Ontario mills also cut small quantities of sycamore, sassafras, willow and ironwood.

Mr. R. G. Lewis in a report prepared for the Dominion Forestry Branch describes the principal trees that are cut in Canadian saw-mills as follows:—

DOUGLAS FIR.

"Douglas fir is cut in Canada in larger quantities than any other single species. Timbers of this wood can be obtained in larger dimensions than of any other Canadian species. The tree has been unfortunately misnamed, as it is not a fir (*Abies*) but belongs to a distinct genus of which there are no other species in Canada. The wood is sold under many erroneous names, two of the commonest being "Douglas spruce" and "Oregon pine," which have resulted from attempts made to classify it with the woods of the east. "Yellow" and "red" fir are names caused by differences in growth and do not refer to different species of this wood.

The northern range of this tree in British Columbia is imperfectly known. It crosses the Rocky mountains and is cut in small quantities in Alberta. The largest trees, producing the finest lumber, are cut in the Puget Sound district of the Coast region.

WHITE SPRUCE.

"White spruce probably forms the greatest part of the spruce cut in Canada, as this tree is abundant in every province but British Columbia, and its range in this province is not definitely known. A small quantity cut in the Yukon Territory is included in the total for British Columbia. It is the most important spruce in Quebec, Ontario and the three Prairie Provinces. Red spruce is the important species in the Maritime Provinces and southeastern Quebec. It is found only to a very limited extent in Ontario and does not occur west of this province. Black spruce has a wider range than white spruce and is found farther south in British Columbia, although it is of less commercial importance than any of the spruces. The tree is largely confined to low swampy situations and seldom reaches saw-timber size. The important spruces in British Columbia are Englemann and Sitka spruce. Englemann spruce is a Rocky mountain species and is cut in some Alberta mills. Sitka spruce is confined to the Coast region of British Columbia. The production of Englemenn spruce in British Columbia in 1913 was about 32,795,000 feet board measure, valued at $15.11 a thousand. The production of Sitka spruce was 28,396,000 feet, valued at $15.34 per thousand.

WHITE PINE.

"White pine is cut from one species only in Eastern Canada. The tree grows throughout the Maritime Provinces and in Ontario and Quebec south of the height of land between the St. Lawrence and Hudson bay. It just reaches southeastern Manitoba, and has been cut in small quantities in that province. The western species is confined to British Columbia and is a smaller tree than the eastern. It seldom occurs in pure stands and is not at present of great commercial importance.

RED OR NORWAY PINE.

"Red or Norway pine is a similar wood to white pine, but is usually harder and stronger and contains more resin. Many saw-mills do not distinguish between the two species, and therefore some of the lumber attributed to white pine is probably red or Norway pine. This tree has the same distribution as white pine, but is often found farther north.

EASTERN AND WESTERN HEMLOCK.

"Eastern hemlock is found in Canada throughout the same range as white pine, not extending, however, as far north or as far west as pine. The wood is important chiefly on account of its cheapness and abundance. The western species, which is cut only in British Columbia, is a much more valuable wood and has none of the objectionable qualities of the eastern species.

EASTERN AND WESTERN CEDAR.

" While eastern cedar is quite common in New Brunswick it is almost a curiosity in Nova Scotia. It is cut in greatest quantities in Ontario and Quebec where it grows as far north as James bay. The tree occurs in small isolated stands around lake Winnipeg but is comparatively rare in Manitoba and is entirely absent from the forests of Saskatchewan and Alberta. The western species is a much larger tree, usually with enormously enlarged or buttressed base; it is one of the most important shingle woods of Canada, as it provides larger shingle bolts free from defects than the eastern species. The western species is found in Canada only in British Columbia, but extends to the north along the coast into Alaska.

TAMARACK AND WESTERN LARCH.

" Tamarack grows as far north as any tree species in America, reaching, with black and white spruce, the limits of tree-growth. The species forms a large percentage of the forest of interior Labrador, and extends to the mouth of the Mackenzie river and through the Yukon Territory to interior Alaska. In the southern part of its range the tree reaches commercial size, but to the north it is confined to sphagnum swamps or muskegs and is of no commercial importance as lumber.

" Western larch is a much larger tree and is found only in British Columbia. An alpine species (*Larix lyalli*) is found through the Rocky mountains and the mountains of interior British Columbia, but it seldom occurs below 6,000 feet and is of no commercial importance as lumber.

DIFFERENT KINDS OF BIRCH.

" The cut of birch is made up of the wood of some seven species, three of which are of no commercial importance. Yellow birch is the most important commercially in point of quantity produced and its wood is probably the most valuable. The tree grows as far north as lake Abitibi and extends westward about half-way along the north shore of lake Superior.

" Sweet birch is common in the eastern United States. Its range in Canada is imperfectly understood. Many of the so-called sweet birch logs are cut from mature trees of yellow birch, which closely resembles this species. The tree is not commercially important in Canada. Paper birch is a much inferior tree to the two preceding species, but has a much more extensive range. It does not, as a rule, reach very large dimensions, and is not important as a lumber-producing tree at the present time. Western birch grows only in British Columbia and while comparatively rare it reaches larger dimensions and produces more clear lumber to the tree than any other birch in America.

DIFFERENT SPECIES OF MAPLE TREES.

" There are six or eight species of maple that reach tree size in Canada, but only sugar maple, silver maple, red maple and broad-leaved maple can be properly considered as commercially important as lumber producing trees. Sugar maple is the most important as to both quantity and quality of lumber produced, and this tree probably provides the greater part of the maple lumber sold. The two soft maples, silver maple and red maple, are

inferior in quality and are nowhere as abundant as sugar or hard maple. These three trees are cut only in Eastern Canada and are not found west of Ontario. Sugar maple is found in the same range as yellow birch and has the most extensive range of any of the maples. Silver and red maple, usually sold as soft maple, produce inferior lumber and their range does not extend as far north. Broad-leaved maple is cut only in limited quantities in British Columbia."

CHARACTER OF BRITISH COLUMBIA WOODS.

Mr. H. R. Macmillan, Chief Forester of British Columbia, has prepared for the Canadian Department of Trade and Commerce a description of the characteristics and uses of the four British Columbia woods of greatest commercial importance, viz.: the Douglas fir, the red cedar, the hemlock and the British Columbia spruce, from which the following information is condensed:

The Douglas fir, of which there are many billion feet now standing, has remarkable strength and elasticity as shown by the severest tests in competition with other woods, and yet it is 22 per cent lighter in weight than the next best soft wood structural timber. Its use for general house building, railway cars, packing houses, bridge and trestle work for railways, ships, barges, scows, dock, wooden pipes, and warehouses, where it is subject to moisture, rapid changes in temperature and great stress and strain have proven its high resistance to decay. The ease with which it absorbs creosote and its natural hardness make it an ideal paving block material. Sawn edge-grain, it makes a superlative floor, taking a high polish, never splintering, wearing long and evenly. Its strength, ease of working and cheapness have made it popular in sash and door factories. Its beauty of grain, hard surface, ease of working, resistance to warping, shrinking or swelling and its ability to take stains and paints make it especially suitable for finishing.

The British Columbia red cedar reaches a maximum size of 200 feet in height and 15 feet in diameter, averaging from 100 to 150 feet in height and three feet in diameter. It is exceptionally light weighing 23 pounds to the cubic foot kiln-dried. It is a soft wood of close, straight grain, takes stains and paints readily and holds them well, while changing conditions of weather such as heavy rains or snows with alternating dry, hot weather do not cause it to warp, twist or decay. These qualities make it eminently suitable for outside walls, porch roofs columns or posts or for construction of lattices, trellises, pergolas, arbours, and summer houses. It makes a peerless roof which is cool in summer, warm in winter, will not sweat, leak or crack and requires only light supporting framing. Most beautiful effects on both roofs and sides of buildings can be obtained with fancy stained shingles. British Columbia red cedar shingles are sawn edge-grain and for this reason lie flat and will not warp or twist. By wetting shingles 24 hours before laying, using 3d zinc, copper or galvanized nails, the life of the roof will be doubled. Its durability, suitable taper, long lengths and its resistance to decay at the ground line make British Columbia red cedar ideal for posts, telephone poles and trolley poles. Its high resistance to weather action and the long, wide, clear lumber obtainable make it

unequalled for row-boats, canoes and motor-boats. The beautiful distinctive grain and smooth, high finish of British Columbia red cedar, the fact that it takes and holds stains so admirably, while it never warps, splits or twists and can consequently be used in wide panels makes it an interior finish material second to none where it is not subjected to rough usage. The odour of British Columbia red cedar, so pleasant to human beings is obnoxious to moths and similar insects, making it a most desirable lining for closets and store-rooms and it will not soil or crack like plaster.

British Columbia hemlock is quite different from the eastern hemlock. It is of fine grain, soft, light and strong. It reaches a maximum height of 200 feet with a diameter of five feet, averaging 130 feet in height and a diameter of from two to three feet. It weighs 32 pounds per cubic foot kiln-dried and has only twelve per cent less strength than the Douglas fir. It is especially suitable where ease of working, handsome finish, strength, lightness and tastelessness are desired, but needs paint or other preservatives when exposed to the weather. For framing and shelving it serves as well as Douglas fir. It makes an excellent flooring when cut edge-grain and used in dry places. It finishes smoothly on account of uniform texture and wears evenly. Containing practically no pitch, having a beautiful grain, and taking stains readily it can be used for inside finish and when properly dried will not swell or shrink under normal conditions. It presents a comparatively hard surface and consequently it makes good, cheap box material, but it is not adapted for direct contact with foodstuffs except when dry. It makes good laths. It is commonly used by western farmers for rat and mouse proof buildings and receptacles. Exhaustive tests have shown that it is suited for all but the heaviest construction work and it has been found satisfactory for piling on the British Columbia coast.

British Columbia spruce is the largest of all spruces, having a maximum height of 200 feet with 10 feet diameter, while it averages when fully developed 150 feet in height with a diameter of from four to five feet. The weight is 26 pounds per cubic foot kiln-dried. The wood is white in colour, odourless and tasteless, of tough fibre, does not warp and is free from resin and pitch. It does not split easily in nailing even when worked to the thinnest possible thickness for the manufacture of boxes, and its light weight gives it a low transportation cost. While not sufficiently strong for heavy structural work, it is well suited for many uses in general building. Its ease of working, light weight and ability to take and hold nails particularly adapt it for framing, sheathing, shelving and sub-flooring. Its whiteness, tastelessness and freedom from resin and pitch make it particularly suitable for sink and laundry boards in houses and hotels, refrigerators and the lining of refrigerator cars, and it is the most popular wood used in the construction of containers for the marketing of food products, such as butter and cheese, lard, meats, fish, berries, dried and canned fruits and baking products, British Columbia factories being equipped to do a large business in all kinds of boxes and shooks. As a finish material it is soft and easily worked, takes and holds paints well and has an attractive cloudy appearance when stained. It is obtainable in large widths and lengths. Being tough, of light weight and sufficient strength, it is used for the manufacture of large doors for garages, freight warehouses and dock buildings. It is unsurpassed for oar and paddle stock.

TIMBER AND LUMBER.

The capital invested in Canada in producing logs in 1910 was $146,395,438, according to the Dominion census, and the output was valued at $105,596,190. In the manufacture of lumber the capital investment was $52,547,261, and the output was valued at $39,805,515.

The value of exports during the fiscal year 1914 was as follows:—

	1914.
Bark for tanning	$25,577
Firewood	49,608
Knees and futtocks	33,404
Lathwood	258
Logs—	
Cedar	376,046
Elm	33,721
Hemlock	11,276
Oak	811
Pine	62,743
Spruce	95,483
Tamarack	25,473
Other logs	212,836
Lumber—	
Battens	5,426
Basswood	14,992
Deals, pine	1,408,709
Deals, spruce and other	6,547,854
Deal ends	294,195
Hickory	2,993
Laths	1,699,221
Palings	20,657
Pickets	206,573
Planks and boards	19,514,128
Scantlings	1,264,881
Shingles	1,775,619
Shooks	189,777
Staves and headings	70,249
Other lumber	257,602
Match blocks	6,739
Masts and spars	3,499
Piling	176,959
Poles, hop, hoop, telegraph and others	127,354
Posts, sleepers and railway ties	247,996
Shingle bolts of pine or cedar	47,132
Timber, square—	
Ash	3,414
Birch	133,805
Elm	78,742
Oak	72,479
Pine, red	12,150
Pine, white	265,106
Other square timber	30,499
Pulpwood	7,388,770
Ashes—	
Pot and pearl	19,218
Other ashes	29,644
Other forest products	8,519

REPORTS OF SAWMILLS.

The annual statistics issued by the Forestry Branch of the Department of the Interior are compiled from reports received from saw-mills. As all the saw-mills of the country do not report these statistics do not give the total production of lumber, but the following table from the report of 1914

gives an approximate idea of the quantities of the different kinds of wood cut into lumber the previous year.

Kind of wood.	Quantity.
Spruce	1,274,215,000
Douglas fir	793,143,000
White pine	678,330,000
Hemlock	306,342,000
Red pine	144,320,000
Cedar	101,053,000
Tamarack	96,325,000
Birch	79,369,000
Maple	73,580,000
Balsam fir	64,957,000
Yellow pine	58,939,000
Basswood	36,009,000
Jack pine	35,404,000
Elm	30,766,000
Beech	12,983,000
Poplar	11,136,000
Ash	10,509,000
Oak	6,348,000
Chestnut	1,317,000
Hickory	647,000
Butternut	516,000
Cherry	246,000
Black gum	125,000
Walnut	40,000
Tulip	20,000
Sycamore	11,000
Sassafras	1,000
Willow	......
Ironwood	......

The number of laths reported cut was 739,678,000 and the number of shingles 1,485,279,000.

WOODPULP, CHEMICAL AND MECHANICAL.

According to the census $30,782,373 was invested in 37 establishments manufacturing woodpulp in 1910, and the value of the year's product was $9,117,465. A report published by the Forestry Branch of the Department of the Interior in 1914 stated that reports had been received in 1913 from forty-eight concerns operating sixty-four pulp mills, of which 34 were in Quebec, 17 in Ontario, 6 in Nova Scotia, 4 in New Brunswick and 3 in British Columbia. A little more than half the pulpwood produced in Canada is made into pulp in Canada 1,109,034 cords were used by the pulp mills reporting to the Forestry Branch in 1913. In mechanical processes of pulp manufacture 600,210 cords were used; in the sulphite chemical process 367,105 cords; in the sulphate process 136,569 cords and in the soda process 5,144 cords. An increasing proportion of the pulp made in Canada is manufactured by the sulphate process. In 1914, 151,563,300 pounds of chemically prepared woodpulp valued at $2,923,083 and 481,617,000 pounds of mechanically prepared woodpulp valued at $3,441,741 were exported, a total value of $6,364,824. In 1915 woodpulp exports were valued at $9,266,161. Thus the exports of woodpulp in 1915 were greater in value than the whole production of woodpulp in 1910 as shown by the Dominion census, while very large quantities were used in Canada in the manufacture of paper and other products.

PAPER MANUFACTURE.

There were 35 paper mills in Canada in 1910 with a capital investment of $23,104,560 and the year's output was valued at $14,109,014. Four establishments with a capital investment of $1,054,548 made wallpaper valued at $1,115,290. The values of exports of the different kinds of paper in 1914 and 1915 were as follows:—

	1914.	1915.
Printing paper..	$11,386,845	$14,091,662
Wrapping paper..	615,310	408,360
Wallpaper	45,328	53,916
Felt paper..	50,131	85,066
Other paper..	589,282	870,578

PAPER BOXES AND BAGS.

Fifty-four establishments made paper boxes and bags in 1910. The capital investment was $3,910,865 and the year's product was valued at $3,361,023. There were seven cardboard factories with a capital investment of $831,482 and the year's product was valued at $506,077, while six establishments with a capital investment of $89,352 made paper patterns, the year's products being valued at $272,335.

PAPER BOTTLES AND CUPS.

One of the new industries is the manufacture of paper bottles and paper cups. Paper bottles are extensively used in the delivery of milk and for other purposes.

STATIONERY GOODS.

Twenty-two establishments with a capital investment of $1,219,812 made stationery in 1910. The year's products were valued at $1,423,972.

WOODEN BOXES AND BASKETS.

All kinds of wooden packing boxes and baskets are made from the largest cases for the packing of heavy hardware and dry-goods to the smallest boxes and baskets for fruit. Four establishments with a capital investment of $284,500 made cigar boxes, the value of the year's product being $283,485. In the manufacture of other wooden boxes $3,458,069 was invested. There were 119 factories and the year's output was valued at $3,386,327. There were 21 basket factories with a capital investment of $436,950 and the year's output was valued at $443,720. Eleven establishments with a capital investment of $405,100 made box shooks. The year's products were valued at $2,350,675.

COOPERAGE.

In cooperage industries $2,065,871 was invested in 1910. There were 113 factories and the year's output was valued at $2,409,577. The exports of empty barrels were valued at $14,228 in 1914.

FURNITURE AND UPHOLSTERED GOODS.

There were 172 establishments manufacturing furniture and upholstered goods in 1910. The capital investment was $13,746,262 and the year's output was valued at $12,369,366. Household furniture exports were

valued at $411,074 in 1914 and at $299,679 in 1915. Canadian household furniture was shipped to 26 countries. The largest purchaser was Australia. The manufacture of office furniture is an important Canadian industry. Mouldings, trimmings and other house furnishings to the value of $5,601 were exported in 1914.

SHOWCASES.

There were ten establishments manufacturing showcases in 1910. The capital investment was $344,076, and the value of the year's output was $360,114.

MATCHES.

There were four establishments making matches in 1910. The capital investment was $480,475, and the year's output was valued at $349,337. During the fiscal year 1915 the value of Canadian matches exported was $13,363.

DOORS, SASHES AND BLINDS.

The manufacture of doors, sashes and blinds is carried on extensively in all the provinces of Canada for home consumption. The exports were valued at $20,609 for the fiscal year 1914 and at $12,440 for the fiscal year 1915. Nine factories made window blinds and shades. The capital investment was $1,007,815, and the year's output was valued at $945,980.

COFFINS AND CASKETS.

There were twenty-two factories making coffins and caskets in 1910. The capital investment was $1,787,575, and the year's output was valued at $1,447,358.

ARTIFICIAL LIMBS AND TRUSSES.

Four factories made artificial limbs and trusses in 1914. The capital invested was $73,300, and the year's output was valued at $71,110.

INCUBATORS.

In the manufacture of incubators $202,200 was invested in 1910. There were three factories, and the year's output was valued at $154,550.

PUMPS AND WINDMILLS.

Twenty-nine factories made pumps and windmills in 1910. The capital investment was $1,405,505 and the year's output was valued at $1,613,222.

REFRIGERATORS.

In the manufacture of refrigerators, $715,562 was invested in 1910. There were five factories, and the year's output was valued at $586,000.

WOODENWARE.

Seven factories made woodenware in 1910. The capital investment was $351,217, and the year's product was valued at $360,114. Exports of wooden pails, tubs, churns and other hollow woodenware were valued at $4,554 in 1914.

SPOOLS AND SPOOLWOOD.

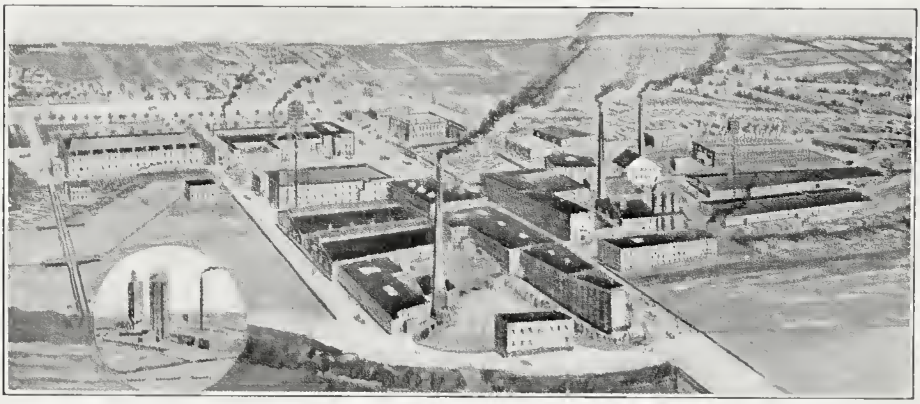
Spools and wood for spools to the value of $27,056 were exported in 1914.

WOODWORKING AND TURNING.

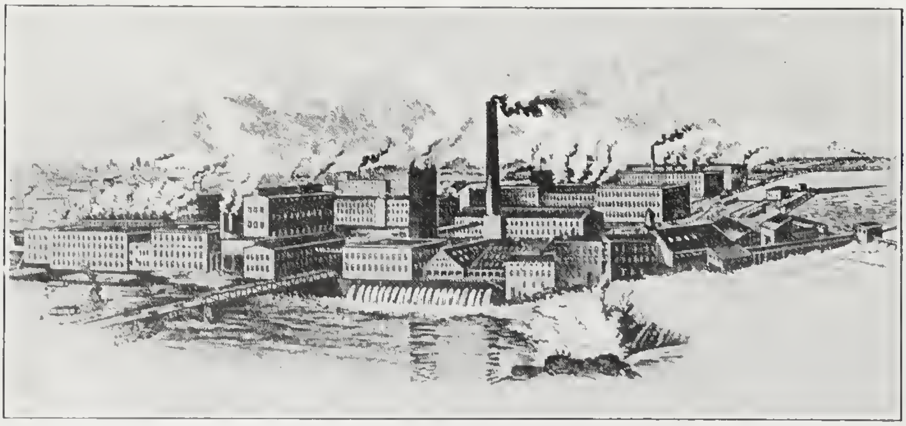
In woodworking and turning and other wood manufacturing industries not specified, $1,812,907 was invested in 1910 according to the census. There were forty-eight establishments with products for the year valued at $1,955,332.

OTHER WOOD MANUFACTURES EXPORTED.

In addition to the wooden manufactures classified in the customs statistics, a variety of wooden articles not separately enumerated are exported. The value was $396,842 in 1914 and shipments were made to twenty-eight countries.



Eddy mills, Hull, manufacturers of pulp, paper, fibreware, woodenware and matches.



Booth mills, Hull, manufacturers of pulp, paper, cardboard and sawmill products.

Chapter XVII.

FARM PRODUCTS AND FOOD MANUFACTURES.

The farm food products of Canada include besides meats all the grain, fruits and vegetables of the northern zone and a variety of manufactured products made from them.

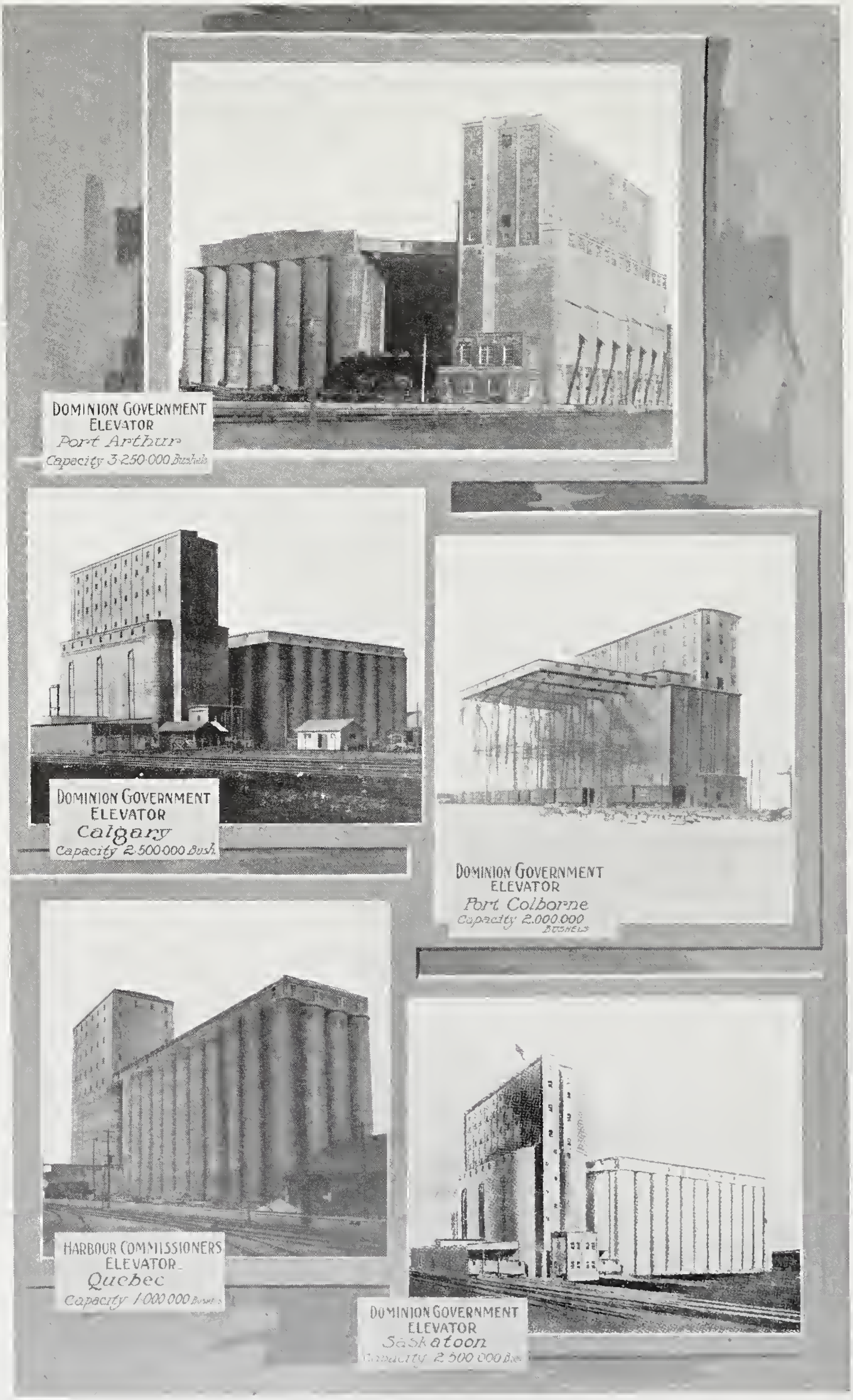
In every province and territory of Canada the climate and other natural conditions are favourable to live stock. The pure, clear, invigourating atmosphere, the abundant supplies of good water everywhere and the luxuriant growth of the grasses most suitable for pasture make the conditions ideal for stock raising in summer. As in other northern latitudes food and shelter must be provided during the winter months, but the cold of winter seems to have an invigourating effect upon animals as well as upon men.

Not only are the natural conditions most favourable to the health of animals, but the Dominion Government regulations designed to prevent the spread of all kinds of contagious diseases are strictly enforced. The Government veterinary staff makes frequent inspections. Diseased animals are destroyed and severe penalties are imposed to prevent the sale of meat from infected animals, while quarantine regulations prevent the importation of diseased stock from other countries. Records of the Government veterinary department for many years show that Canadian farm animals are generally remarkably free from disease. Healthy animals produce wholesome meats.

CENSUS OF LIVE STOCK IN CANADA.

According to the census of 1911 the numbers of farm live stock in the nine provinces of Canada were as follows:—

—	Horses.	Milch Cows.	Other Cattle	Sheep.	Swine.
Prince Edward Island ...	35,935	52,109	68,287	91.232	56,377
Nova Scotia.......	61,355	129,302	158,122	220,907	63,322
New Brunswick	65,458	108,532	113,659	158,216	87,391
Quebec...............	369,237	753,134	697,860	637,062	793,348
Ontario...................	811,585	1,032,979	1,471,694	743,483	1,864,165
Manitoba.	280,374	155,337	279,776	37,322	188,416
Saskatchewan............	507,400	181,146	452,466	114,216	286,295
Alberta	407,153	147,687	592,163	133,592	237,510
British Columbia.........	57,415	33,953	105,230	39,272	33,604
All Canada.......	2,595,912	2,594,179	3,939,257	2,175,302	3,610,428



A typical group of government grain elevators.

LIVE STOCK EXPORTS.

During the fiscal year 1914 the live stock exports of Canada were 3,568 horses, 219,729 cattle, 28,207 swine 20,543 sheep and lambs. The values of live stock exports in 1914 and 1915 were as follows:—

	1914.	1915.
Horned cattle	$7,906,794	$9,267,534
Horses	783,631	1,842,367
Poultry	132,398	335,454
Sheep	128,493	286,612
Swine	446,430	3,117,005
Other living animals	57,337	82,020
	$9,455,083	$14,930,992

MEAT PACKING AND SLAUGHTERING.

According to the census of 1911 there were 70 establishments engaged in slaughtering and packing meat. The capital invested in the industry was $13,746,271 and the year's output was valued at $41,208,796. In slaughtering not including meat packing $1,574,817 of capital was invested in ten establishments and the value of the output was $7,318,280. These figures would not include the slaughter of animals on the farms and by small butchers.

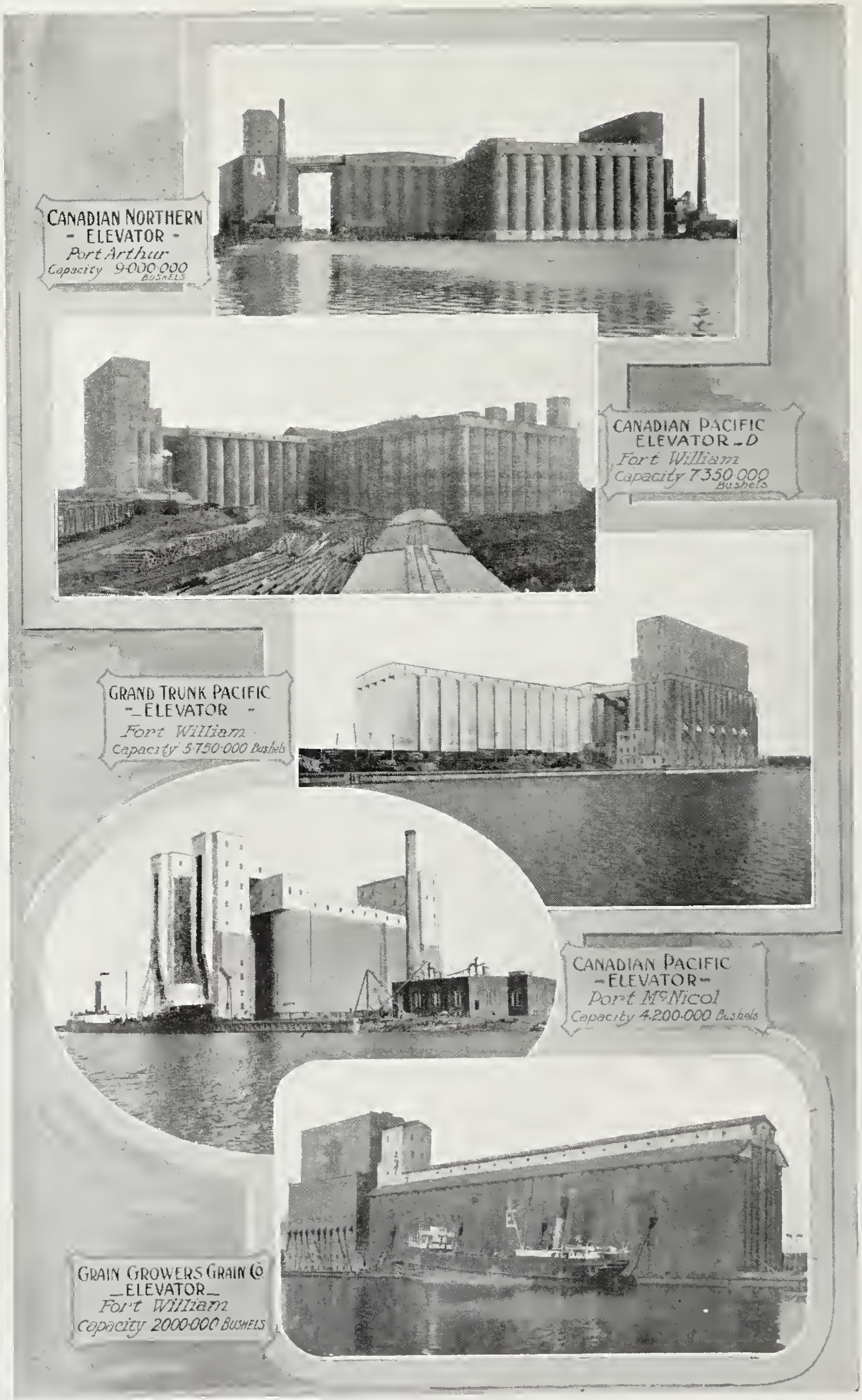
The Census and Statistics Monthly of Canada for May, 1915, says: "In 1907 the Health of Animals Branch of the Department of Agriculture began the organization of a meat inspection service for Canada in accordance with the provisions of the Meat and Canned Foods Act of that year. Under this Act the inspection of all meat and canned goods was made obligatory in respect of establishments engaged in the interprovincial trade or in exporting to foreign countries. Meats and foods other than those in inspected establishments and consumed within the same province as that in which the animals are slaughtered do not at present come within its provisions. The Act having now been in operation for eight years, and records having been annually kept of the animals slaughtered in the establishments inspected, the following table is interesting as indicating the movement in the production of meat in Canada during the last seven years. It shows the number of cattle, sheep and swine slaughtered under the Act in each year from 1907-08 to 1913-14.

Number of cattle, sheep and swine slaughtered under the Meat and Canned Foods Act, 1907.

Year ended March 31.	Cattle. No.	Sheep. No.	Swine. No.
1908*	131,660	86,049	861,989
1909	298,241	191,792	1,532,796
1910	384,789	257,049	1,261,496
1911	411,308	329,017	1,452,237
1912	408,401	376,437	1,852,997
1913	450,390	455,647	1,607,741
1914	531,994	499,284	1,799,060

*Eight months.

"It has usually been assumed that the meat inspected under the Meat and Canned Foods Act represents on the average about half of the total meat production of Canada; but it would hardly be safe to accept this proportion in any endeavour to arrive at the per capita consumption of meat. The



Typical railway grain elevators

question has been investigated by officers of the Meat Inspection Division of the Health of Animals Branch, and the results of their calculations, based upon the census returns of animals slaughtered and sold off farms in 1910, upon the exports and imports of meat for the same year and upon the meat inspection statistics, have been made available for the purposes of this note. They show that in 1910 the total production of beef for consumption in Canada was about 426,451,000 pounds, of mutton 63,582,000 pounds, and of pork 466,955,000 pounds, or a total for the three descriptions of 956,988,000 pounds."

EXPORTS OF MEATS.

The exports of meats during the fiscal years 1914 and 1915 were as follows:—

	Pounds. 1914.	Pounds. 1915.
Bacon	23,620,861	76,801,419
Beef	13,133,205	18,828,257
Hams	1,890,182	17,958,874
Mutton	65,167	1,064,963
Pork	1,811,204	21,288,226
Canned meats	638,583	9,882,662
Other meats	2,849,082	4,595,906
Lard	125,619	2,689,036

In addition to these meats poultry valued at $73,972 and game valued at $4,831 were exported in the fiscal year 1914, while in the fiscal year 1915 exports of poultry and game were valued at $212,992 and $2,340 respectively. The total value of all meats exported during the fiscal year 1914 was $5,826,371 and during the fiscal year 1915, $22,373,874.

Owing to the rapid growth of Canadian cities and towns the home consumption of meats has been very large in recent years. As many of the western farmers who have in the past devoted their attention almost exclusively to grain growing are likely to become mixed farmers in the future a large increase in meat exports may be expected.

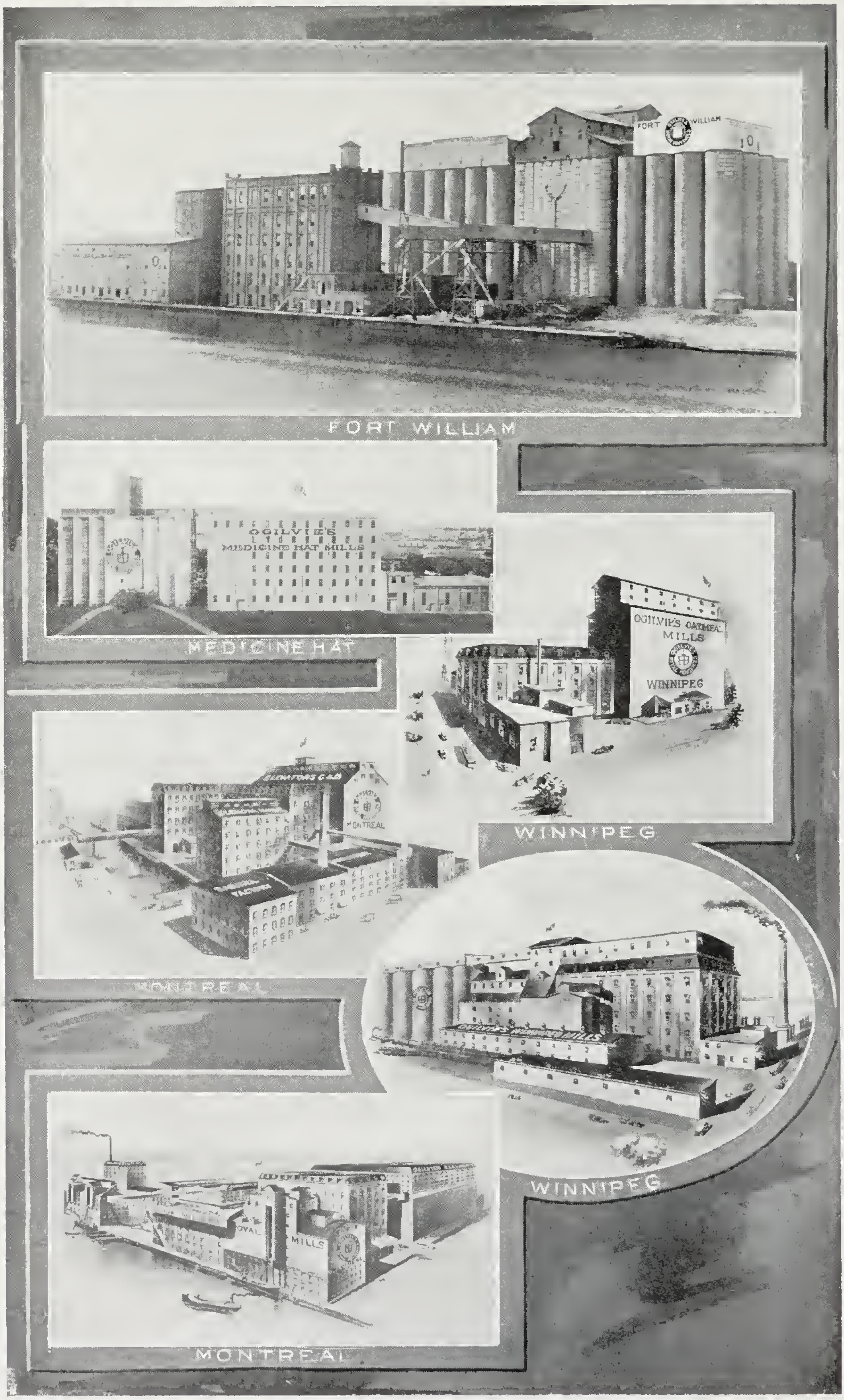
FIELD CROPS IN 1915.

The exact yield of the various field crops in 1915 is as yet uncertain, but the provisional estimate of the principal grain crops of Canada in 1915 published by the *Census and Statistics Monthly* for October was as follows:—

	Bushels.
Wheat	336,258,000
Oats	481,035,500
Barley	50,868,000

ONE YEAR'S DROUGHT REDUCED AVERAGE.

In considering the following tables of the average annual yields of the principal field crops for the five years 1910-1914 it should be noted that owing to an unusual drought the crops for the year 1914 were much below the general average and thus reduced the average. For instance the average yield of wheat for the five years is shown to be 196,025,753 bushels, but in 1913 the wheat crop amounted to 231,717,000 bushels while in 1914 it was only 161,280,000 bushels. In 1913 the crop of oats amounted to 404,669,000 bushels, but in 1914 the yield of oats was only 313,078,000 bushels.



Ogilvie flour mills, total capacity 17,500 barrels daily.

WHEAT, OATS, BARLEY, RYE AND BUCKWHEAT CROPS.

The average annual yields of wheat, oats barley, rye and buckwheat for the five years ending with 1914 were as follows:—

—	Wheat.	Oats.	Barley.	Rye.	Buckwheat.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Prince Edward Island....	623,259	6,328,917	121,486	....	73,600
Nova Scotia	259,657	3,089,353	140,044	5,673	259,201
New Brunswick....	245,071	5,913,159	69,550	....	1,582,596
Quebec..............	1,029,798	37,178,834	2,279,874	166,785	2,629,495
Ontario............	18,911,926	95,083,608	14,289,265	1,515,898	4,086,243
Manitoba...............	50,353,589	47,255,875	12,282,926	88,241	....
Saskatchewan...	95,613,399	91,996,358	7,327,801	50,327	....
Alberta..................	28,639,240	54,276,244	4,831,033	1,638,806	....
British Columbia..	349,814	2,489,906	93,900	... .	....
All Canada........	196,025,753	343,612,254	31,435,879	3,465,730	8,631,135

FLAX, MIXED GRAINS, PEAS, BEANS AND CORN.

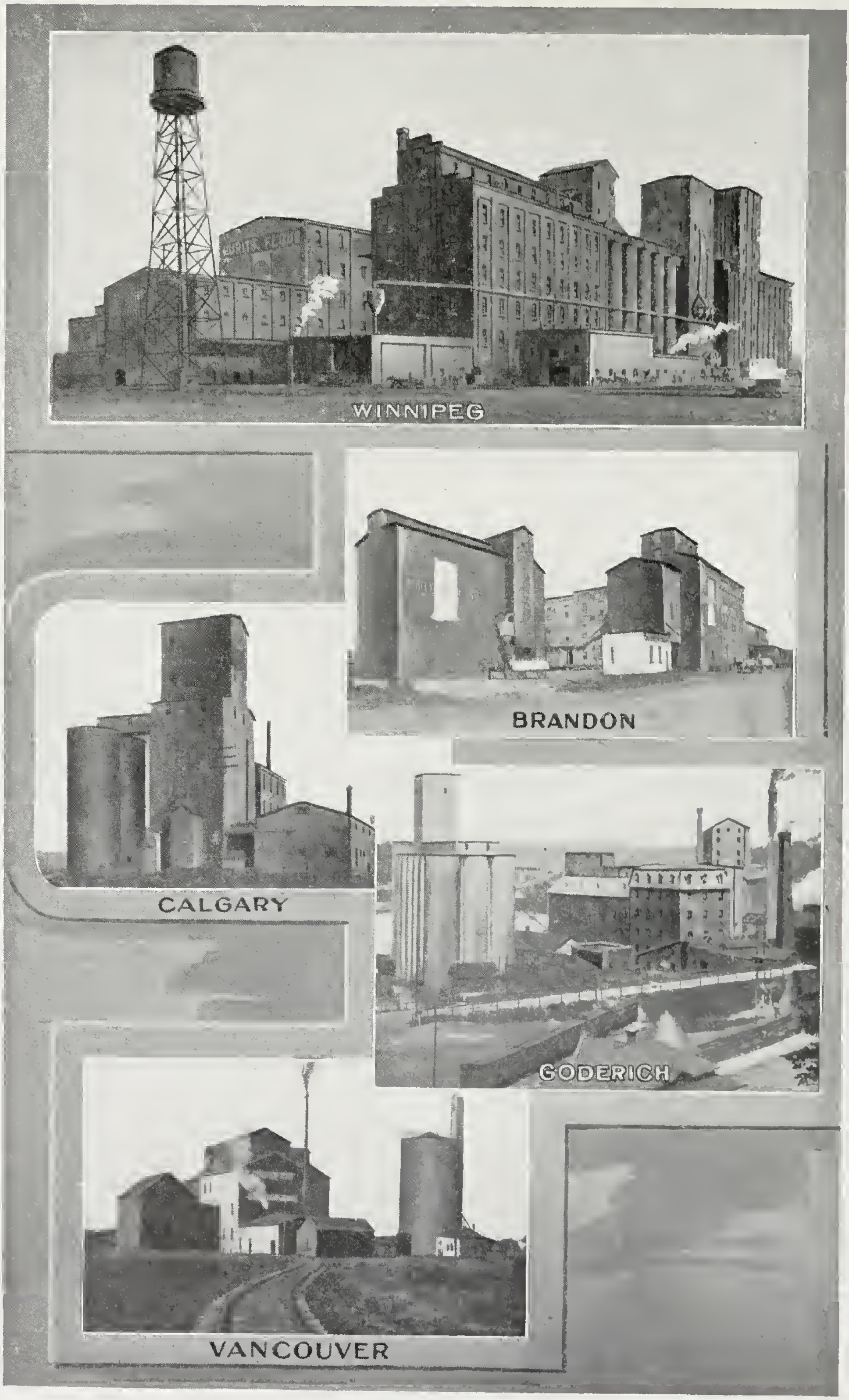
The average annual yields of flax, mixed grains, corn, peas and beans for the five years ending with 1914 were as follows:—

—	Flax.	Mixed Grain	Peas.	Beans.	Indian Corn.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Prince Edward Island....	....	303,474	1,889	....	....
Nova Scotia	....	128,873	4,554	19,550	3,536
New Brunswick	....	28,485	10,913	5,862	964
Quebec....	10,510	2,747,554	456,219	92,116	572,672
Ontario....	119,580	12,188,351	3,607,026	751,591	15,653,453
Manitoba	710,135	40,354	4,772	....	....
Saskatchewan........ ...	11,261,732	50,893	5,722	....	....
Alberta..................	930,896	72,511	7,594	....	... .
British Columbia	....	91,760	41,595	5,149	....
All Canada........	13,032,853	15,652,255	4,140,284	874,268	16,230,625

POTATOES, SUGAR BEETS AND OTHER VEGETABLES.

The average annual yields of potatoes, sugar beets and other vegetables for the five years were:—

—	Potatoes.	Sugar Beets.	Turnips, Mangolds.
	Bushels.	Tons.	Bushels.
Prince Edward Island.........	5,909,905	....	3,576,156
Nova Scotia...............................	6,240,751	....	4,452,588
New Brunswick..	8,555,052	....	3,047,676
Quebec....	17,914,134	....	3,757,159
Ontario......	19,981,074	155,424	47,709,173
Manitoba...........	4,565,967	.. ..	1,072,334
Saskatchewan..........................	4,840,468	....	2,964,487
Alberta..	4,144,580	8,695	1,090,835
British Columbia....	3,037,840	....	7,554,494
All Canada...............	75,189,771	164,119	75,224,902



Five of the mills of the Western Canada Flour Mills Co., Ltd.; total capacity 10,500 barrels daily.

HAY, CLOVER, ALFALFA AND FODDER CORN.

The average annual yields of hay, clover, alfalfa and fodder corn for the five years ending with 1914 were as follows:—

—	Hay and Clover.	Alfalfa.	Fodder Corn.
	Tons.	Tons.	Tons.
Prince Edward Island	295,658	138	2,432
Nova Scotia	861,278	77	4,501
New Brunswick	787,505	306	1,579
Quebec	4,484,538	8,504	289,602
Ontario	4,420,291	151,227	2,479,968
Manitoba	1,079,954	7,393	67,031
Saskatchewan	88,625	2,779	6,095
Alberta	253,132	21,426	1,758
British Columbia	298,499	25,580	3,007
All Canada	12,569,480	217,430	2,855,973

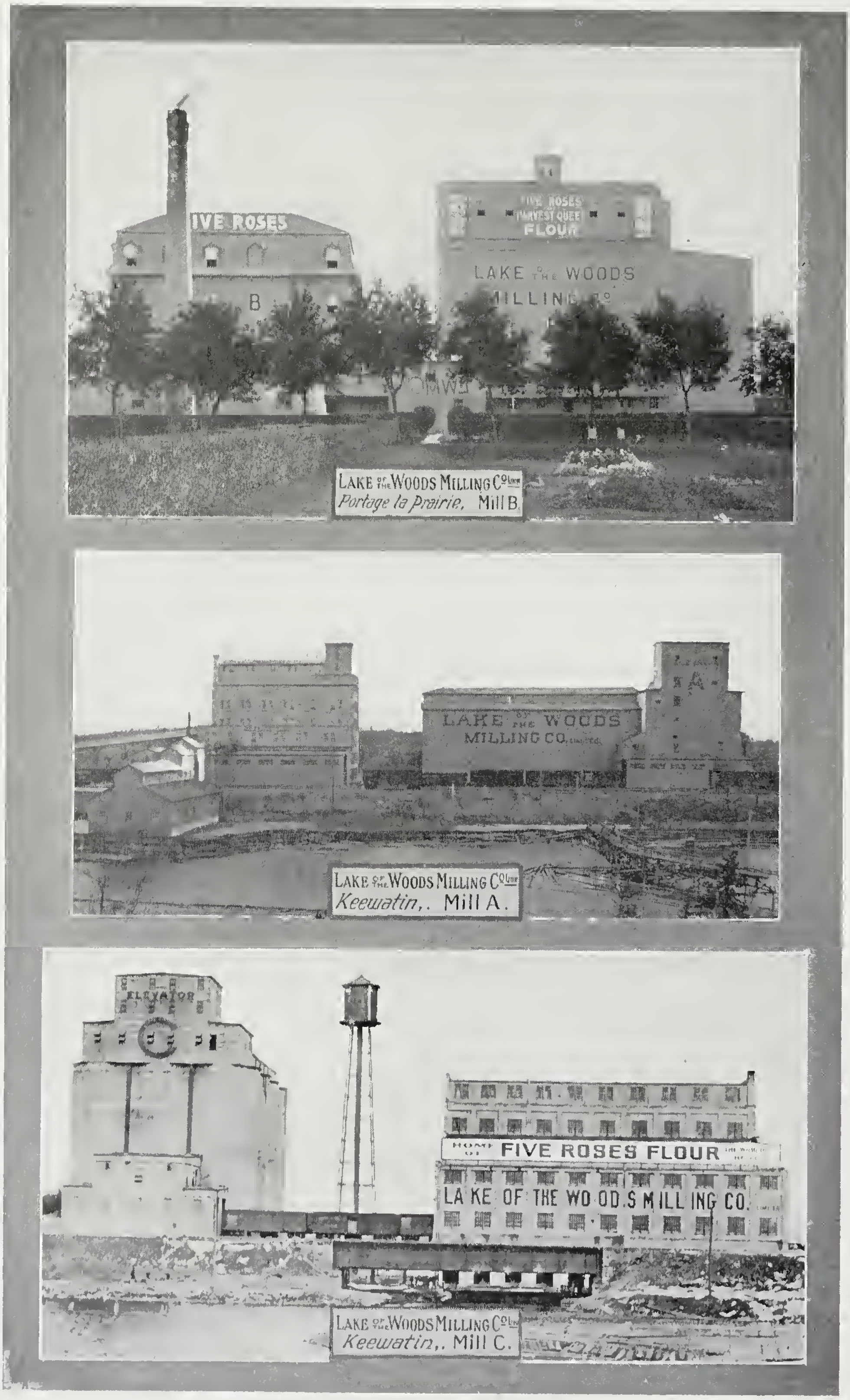
YIELD COMPARED WITH EXPORTS.

The average annual yield of the principal field crops may be compared with the exports as follows:—

—	Annual Average.	Exports 1914.	Exports 1915.
	Bushels.	Bushels.	Bushels.
Wheat	196,025,753	120,426,579	71,913,385
Oats	343,012,254	34,996,664	17,768,166
Barley	31,465,879	13,032,369	5,576,646
Rye	3,495,730	112,436	263,422
Buckwheat	8,631,135	172,802	343,349
Flaxseed	13,032,853	20,647,327	7,680,525
Mixed Grains	15,652,255	....	....
Peas	4,140,284	142,730	261,354
Beans	874,268	11,377	28,661
Indian Corn	16,230,625	30,813	376,663
Potatoes	75,189,771	1,980,844	1,192,258
Turnips, Mangolds, etc	75,224,902	1,707,062	2,150,399
Sugar Beets ... tons.	164,119	....	....
Hay and Clover ... "	12,569,480	191,515	131,875
Alfalfa ... "	217,430	....	....
Fodder Corn ... "	2,855,973	....	....

PRODUCTION OF HOPS.

Small quantities of hops are produced in Ontario and British Columbia. Certain sections of both provinces have climatic conditions very favourable to the production of hops. During the fiscal year 1914 exports of Canadian hops amounted to 252,692 pounds, valued at $57,890. During the fiscal year 1915 the exports of hops were 170,226 pounds, valued at $35,892.



Three of the mills of the Lake of the Woods Milling Company; total capacity 12,000 barrels daily.

EXPORT OF SEEDS.

Large quantities of seeds are produced for use on Canadian farms. During the fiscal year 1914 exports of clover seed amounted to 118,601 bushels valued at $1,094,330; grass seed, 110,873 bushels, valued at $106,708, and other seed exports were valued at $58,631, a total value of $1,259,669, without including flaxseed exports valued at $24,816,333. During the fiscal year 1915 the value of seed exports other than flaxseed was only $450,078.

NUT TREES ON FARMS.

Many farms in Ontario, Quebec and the Maritime Provinces have a few nut trees including walnuts, butternuts, hickory nuts and chestnuts. The quantities of nuts produced are not great and they are largely consumed at home, but during the fiscal year 1914 the exports amounted to 15,310 pounds valued at $1,499 while during the fiscal year 1915 they were 36,951 pounds valued at $2,246.

THE TOBACCO CROP.

Ontario and Quebec are the tobacco growing provinces. A few pounds are grown in the other provinces, but not as a commercial undertaking. In Ontario in 1914 five thousand acres were devoted to tobacco growing and the crop amounted to 6,000,000 pounds. In Quebec province there were 4,750 acres of tobacco and the crop was 5,000,000 pounds. The exports of tobacco leaf amounted to 196,524 pounds in 1914 and 36,445 pounds in 1915.

MILK, HONEY AND EGGS.

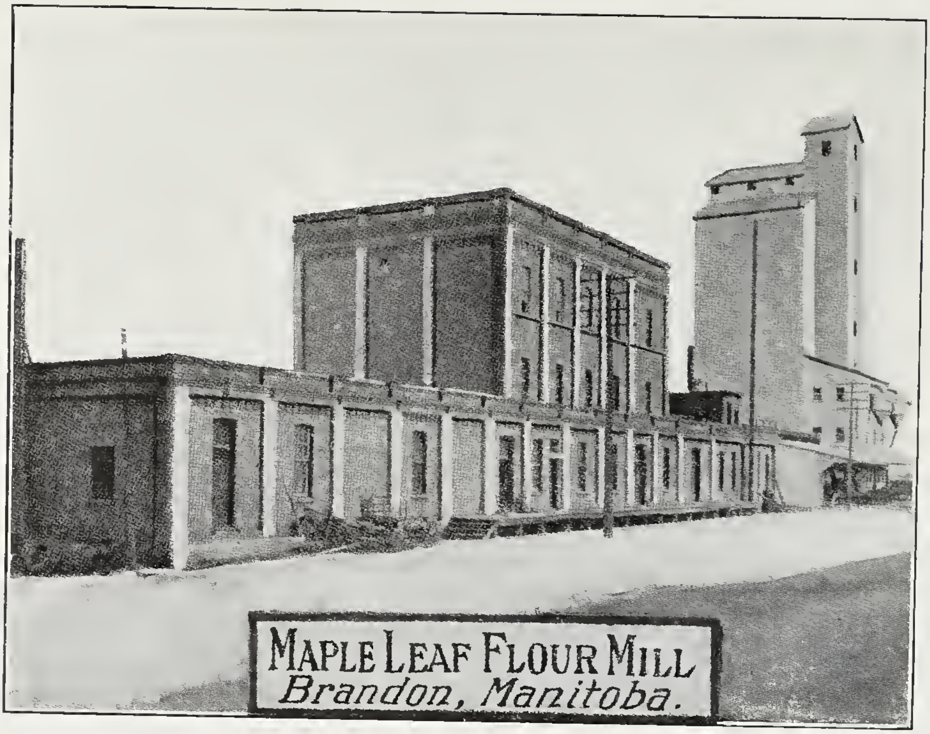
According to the census of 1911 the production of milk in all the provinces amounted to 9,806,741,348 pounds, while 6,089,784 pounds of honey and 123,319,378 dozen eggs were produced. The exports of milk, cream, honey and eggs were as follows during the fiscal years 1914 and 1915:—

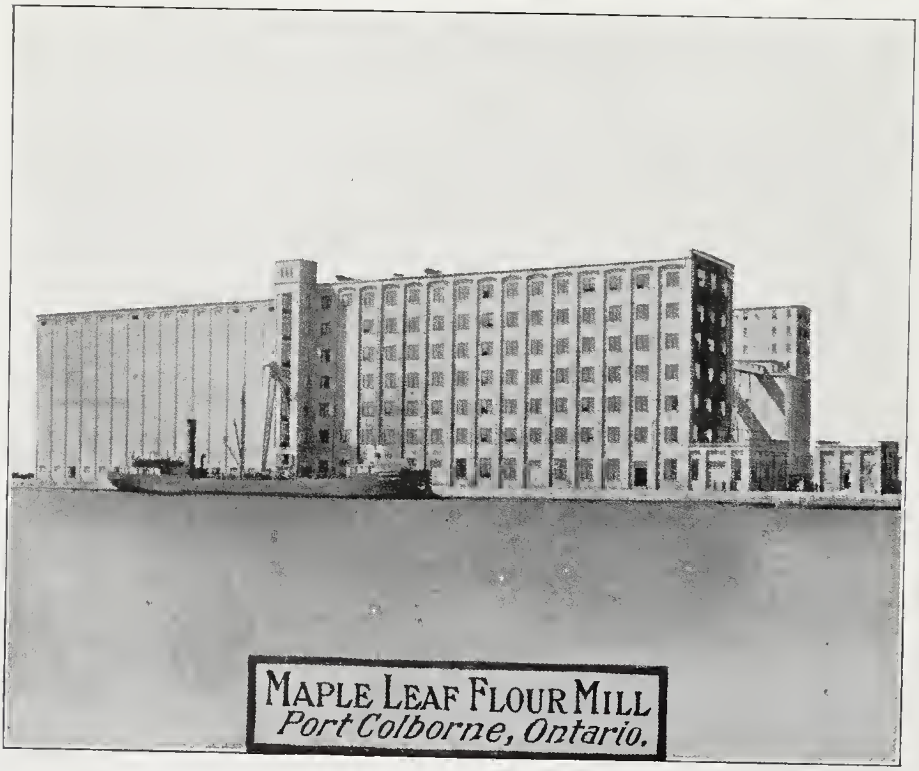
		Exports, 1914.	Exports, 1915.
Fresh milk	gal.	307,188	477,692
Fresh cream	gal.	1,323,929	1,895,575
Honey	lb.	16,069	6,929
Eggs	doz.	124,002	3,592,899

Nearly all the fresh milk and cream exported went to the United States. The value of fresh cream exports for the fiscal year 1915 was $1,836,006.

MAPLE SUGAR AND MAPLE SYRUP.

Many farms in Ontario, Quebec, and the Maritime Provinces have groves of sugar maples and considerable quantities of maple sugar and maple syrup are produced. During the fiscal year 1914 the exports of maple sugar amounted to 1,925,343 pounds valued at $159,619 and exports of maple syrup to 5,205 gallons valued at $5,284. During the fiscal year 1915 the exports of maple sugar were 1,462,416 pounds valued at $131,477 while exports of maple syrup were 6,164 pounds valued at $6,687.





Two of the eight mills of the Maple Leaf Milling Company, having a total capacity of over 15,000 barrels daily.

THE PRODUCTION OF FRUIT.

According to the Dominion census of 1911 the nine provinces of Canada had the following acreages devoted to orchards, nurseries, vineyards and small fruits in that year:—

——	Orchards and Nurseries.	Vineyards.	Small Fruits.	Value of Fruits.
	Acres.	Acres.	Acres.	$ cts
Prince Edward Island......	4,350	5	114	154,938
Nova Scotia..................	40,512	140	463	1,634,905
New Brunswick	8,937	68	405	329,066
Quebec	34,060	709	1,961	1,469,537
Ontario........................	268,000	6,521	10,883	7,978,514
Manitoba......................	1,933	190	125	20,103
Saskatchewan	5,625	348	185	4,455
Alberta.........................	7,502	20	66	6,420
British Columbia	33,606	309	1,280	1,394,993
Total..........	397,358	8,310	15,482	12,992,931

LARGE QUANTITIES OF APPLES.

Ontario, Quebec, Nova Scotia and British Columbia all have large quantities of apples available for export. There are many districts in these provinces where climate and soil provide ideal conditions for the production of apples of the finest flavour and good keeping qualities. The officials of the Agricultural Department of New Brunswick believing that province has large areas as suitable for apple growing as any part of Nova Scotia are urging farmers to devote attention to apple growing.

Ontario produces large quantities of peaches, grapes, plums, pears and small fruits. Ontario peaches are considered to have a finer flavour than any grown in the United States. British Columbia is producing all the varieties of fruit grown in Ontario in increasing quantities.

Eighty-two establishments with a capital investment of $5,512,474 produced canned fruits and vegetables in 1910. The year's products were valued at $5,971,082. There were 65 establishments evaporating fruits and vegetables in 1910. The capital investment was $510,065 and the year's products were valued at $448,929. The same companies can fruits and vegetables and they are not given separately in the returns.

THE EXPORTS OF FRUIT.

The exports of fruit during the fiscal years 1914 and 1915 were as follows:—

	Quantity, 1914.	Value. 1914.
Fresh apples.......................brl.	947,382	$3,465,475
Dried or evaporated apples..........lb.	6,082,476	411,789
Fresh berries..............................	......	91,935
Canned or preserved fruits.............	......	394,719
All other fruits.............................	......	220,147

	Quantity, 1915.	Value. 1915.
Fresh apples.. .. ..brl.	1,117,336	$2,657,115
Dried or evaporated apples.. .. ..lb.	4,488,050	276,060
Fresh berries..	......	106,545
Canned or preserved fruits..	......	476,497
All other fruits..	......	80,804

Apple cider exports amounted to 151,073 gallons valued at $19,737 during the fiscal year 1914 and 88,736 gallons valued at $15,715 during the fiscal year 1915. Of the 6,082,476 pounds of dried or evaporated apples exported during the fiscal year ended March 31, 1914, Germany and Holland purchased 5,080,051 pounds.

Exports of canned or preserved vegetables were valued at $17,655 during the fiscal year 1914 and at $299,412 during the fiscal year 1915.

FLOUR, OATMEAL AND OTHER GRIST MILL PRODUCTS.

In the manufacture of flour, oatmeal and other grist mill products $42,905,689 was invested in 1910 and the year's products were valued at $82,494,826. The quantity of flour exported in 1914 was $4,832,183 barrels and the value $20,581,079. During the fiscal year 1915 the quantity exported was $4,952,337 barrels and the value $24,610,946. Flour was shipped to fifty countries. Oatmeal exports during the fiscal year 1914 amounted to 111,527 barrels valued at $488,589. During the fiscal year 1915 oatmeal exports were 60,320 barrels valued at $287,844. Indian meal exports amounted to 3,939 barrels for the fiscal year 1914 and 2,560 barrels for the fiscal year 1915. Exports of other meals amounted to 2,042 barrels in 1914 and 432 barrels in 1915. Bran exports amounted to 2,077,713 hundredweight valued at $1,789,939 during the fiscal year 1914 and to 1,038,132 hundredweight valued at $946,331 for the fiscal year 1915.

PREPARED CEREAL FOODS.

Eleven establishments, with a capital investment of $387,987, made prepared cereal foods in 1910: the year's output was valued at $507,070. The exports of prepared cereal foods were valued at $2,166,330 during the fiscal year 1914 and at $1,970,402 during the fiscal year 1915. Thus the exports of prepared cereal foods in 1914 were more than four times as great in value as the total production in 1910 according to the Dominion census.

BREAD, BISCUITS AND CONFECTIONERY.

In the manufacture of bread, biscuits and confectionery, $16,756,289 of capital was invested in 323 establishments in 1910; the year's products were valued at $25,566,691. Four establishments, with a capital investment of $269,882, made confectioners' supplies valued at $282,017. The exports of biscuits and bread amounted to 202,900 pounds, valued at $16,227, during the fiscal year 1914, and to 303,200 pounds, valued at $26,452, during the fiscal year 1915. Exports of Canadian confectionery were valued at $43,996 for the fiscal year 1914 and at $82,702 for the fiscal year 1915.

PRODUCTION OF BUTTER AND CHEESE.

In 1910 according to the census there were 3,625 cheese factories and creameries in Canada, and the year's production was 199,904,205 pounds of cheese and 64,698,165 pounds of butter. In addition to this factory-made butter and cheese, 138,098,534 pounds of butter and 1,363,261 pounds of cheese were made on the farms of Canada, a total of 202,796,699 pounds of butter and 201,267,466 pounds of cheese.

The production of cheese and butter by provinces in 1910 was as follows:—

	Factory Butter.	Factory Cheese.	Home-made Butter.	Home-made Cheese.
	Lb.	Lb.	Lb.	Lb.
Prince Edward Island.... ..	670,908	3,293,755	2,308,746	9,427
Nova Scotia..................	354,785	264,243	11,665,130	200,170
New Brunswick	849,633	1,166,243	9,152,326	3,717
Quebec	41,782,678	58,171,091	19,701,525	349,763
Ontario.......	14,085,655	136,093,951	63,321,735	295,718
Manitoba..	2,050,487	694,712	10,937,864	327,289
Saskatchewan....	1,548,696	26,730	12,053,201	27,730
Alberta......	2,149,121	193,479	7,689,402	141,964
British Columbia	1,206,202	....	1,268,605	7,483
Total...............	64,698,165	199,904,205	138,098,534	1,363,261

EXPORTS OF BUTTER AND CHEESE.

During the fiscal years 1914 and 1915 the exports of butter, cheese and casein were as follows:—

	1914. Quantity.	1914. Value.	1915. Quantity.	1915. Value.
	Lb.	$	Lb.	$
Butter	1,228,735	309,046	2,724,913	639,625
Cheese..	144,478,340	18,868,785	137,601,661	19,213,501
Casein..	270,486	11,071	230,045	13,923

CONDENSED MILK.

There were eleven factories making condensed milk in 1910, Ontario having six and Nova Scotia two, while Prince Edward Island, Quebec and British Columbia had one each. The production was 27,831,596 pounds, of which 21,552,780 pounds were made in Ontario. The exports of condensed cream and milk during the fiscal year 1914 were 9,339,382 pounds, valued at $666,941. During the fiscal year 1915 the exports amounted to 18,355,975, valued at $1,181,300.

FACTORY-MADE ICE CREAM BLOCKS.

An industry that has recently reached large proportions is the manufacture of ice cream blocks for shipment. There was always a large consumption of ice cream made in restaurants in Canada and the United States but since it has been found that factory-made ice cream can be transported considerable distances the consumption has enormously increased and this industry has created a very large demand for cream, reducing the quantity available for the manufacture of butter and cheese.

COCOA AND CHOCOLATE.

Six factories were making cocoa and chocolate preparations in 1910. The capital investment was $1,291,000 and the output was valued at $1,193,486.

BAKING POWDER AND FLAVOURING EXTRACTS.

Twenty-two establishments made baking powder and flavouring extracts in 1910. The capital investment was $545,819, and the value of the year's product, $63,000. The exports of baking powder during the fiscal year 1914 were 82,724 pounds, valued at $15,386. During the fiscal year 1915 the exports were 84,777 pounds, valued at $13,096.

COFFEE AND SPICES.

In the preparation of coffee and spices for the home market there was an investment of $3,016,012, and the products were valued at $3,274,711.

SUGAR REFINING.

In the refining of sugar there was a capital investment of $19,720,333 in 1910. There were eight refineries and the year's products were valued at $21,260,011. Nearly all the sugar produced is for home consumption. During the fiscal year 1914 the exports of sugar amounted to only 1,909 pounds, valued at $126, and the exports of sugar house syrup to 153,520 gallons, valued at $10,779. During the fiscal year 1915 the exports of sugar were 12,550 pounds, valued at $640, and exports of sugar house syrup, 134,908 gallons, valued at $16,775.

VINEGAR AND PICKLES.

Thirty establishments made vinegar and pickles according to the census of 1911. The capital investment was $1,746,225, and the year's output was valued at $1,408,934.

RICE PREPARATIONS.

Three establishments, with a capital investment of $610,000 and an output valued at $610,000 in 1910, cleaned and polished rice for consumption in Canada.

CHEWING GUM.

The census includes chewing gum among food products. There were eight establishments making chewing gum in 1910. The capital investment was $899,474, and the year's output was valued at $816,069.

SUMMARY OF CONTENTS.

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Chapter VI. The Province of Quebec.

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Chapter X. The Prairie Provinces.

CANADA THE COUNTRY OF THE TWENTIETH CENTURY

GENERAL INDEX

NOTE.—General manufactures are indexed together in the sub-index "Manufactures of Canada"; food manufactures are indexed together in the sub-index "Farm Products and Food Manufactures"; wood manufactures are indexed together in the sub-index "Forest Products and Wood Manufactures"; each of these sub-indexes forming part of the general index.

Abbreviations: Alb., Alberta; B.C., British Columbia; C.B., Cape Breton Island; Man., Manitoba; N.B., New Brunswick; N.S., Nova Scotia; Ont., Ontario; Que. or P.Q., Quebec Province; Sask., Saskatchewan.

MAPS.